Bolton, Herbert
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The Manchester Museum
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MUSEUM HANDBOOKS.

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PARTS II. AND III.

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Curator of the Bristol Museum.

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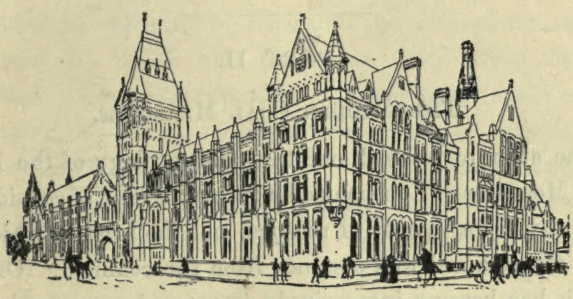

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THE PALÆONTOLOGY OF THE LANCASHIRE COAL MEASURES.

Mr. H. Bolton, F.R.S.E.,
The Museum, Bristol.

PART II.

The Middle Coal Measures.

The attempt to work out the palæontology of the Middle Coal Measures of Lancashire has proved a task of considerable difficulty for a variety of reasons, not the least of which has been my removal to a distance from the coalfield. One fact which has become increasingly impressed upon me is, that, the material facts I have obtained, although large, are yet inadequate to justify any wide systematic correlation of the various seams.

These facts will prove, nevertheless, of the greatest possible value to mine managers and others, as guides in their search for various seams.

The present paper I regard as marking a real starting point in the working out of the palæontology of the Middle Measures, rather than its end, and further work can only be prosecuted successfully by a cordial co-operation between the mine manager and the palæontologist. Co-operation can be effected by diligent collecting of fossils, and the accurate determination of their position with reference to a particular seam, or stratum on the one hand, and on the other of a careful identification of the specimens so collected.

The best work will be done, if, at any particular colliery where fossil collecting is taken in hand, the collector makes a systematic examination of the strata from above downwards

wherever possible, giving a number to each level where fossils occur, and placing the same number upon the fossils obtained at that horizon. The collector ought also to take especial care to get fossils out with a fair amount of the matrix attached, so that no possible doubt can afterwards be raised as to the character of the stratum. The association of the matrix with the fossil will enable the palæontologist to determine with more accuracy the circumstances and conditions in which the particular fossil lived or was entombed. The determination as to whether a fossil was of freshwater, estuarine, or marine habit is helped considerably by an examination of the rock in which it occurs, and only in this way can it be settled whether a fossil is derived from older rocks, drifted from another area, or actually lived in situ.

The best example I know of what may be done by careful collecting, and accurate measurement during sinking operations, is the paper and table of strata given by the late George Wild in Vol. XVIII. of the Society's Transactions. A perusal of that paper will show that the occurrence of fossils has been carefully noted, and most important of all, the depth below, or height above some well-known seam or datum line. That excellent paper emphasises one feature in the description of a section which creates considerable difficulties when correlation of seams is attempted. I allude to the varied terms used throughout the coalfield to describe the various strata met with between the seams; "blue metal," "strong blue metal," "rag" or "gritty metal," "shale," "bing," &c., are all terms capable of several meanings, according to the district in which they are used. If a standard series of specimens of the strata intervening between coal seams could be secured, and a distinctive descriptive title applied to each, it would almost certainly help in the correlation of strata, and prove a more effective guide to

miners than the mass of varied terms used at present. Before proceeding further, I must express the warm thanks which I owe and feel to many members of the Manchester Geological Society whose generous help made my work possible.

To Mr. Mark Stirrup, F.G.S., I and others owe very much because of his earnest insistence for many years upon the necessity for systematic fossil collecting. His efforts bore fruit during the presidency of the late Mr. James Tonge, F.G.S., when the latter with a number of members including Messrs. Atherton, Jones, Howell, Kearsley, Grundy, Mehers, Walls, and Barton, diligently collected a large series of specimens of plant and animal fossils which were presented to the Manchester Museum.

About the same time, Messrs. Cairns, Grundy and Moss, of Ashton-under-Lyne, generously gave me access to their collections, and also gave a valuable series to the Manchester Museum.

The gift of the Kay-Shuttleworth collection, and the purchase of the Wild collection made, with those already mentioned and the previously large nucleus at the Owens College, an assemblage of Middle Coal Measure forms never before equalled. The main bulk of my notes were made when classifying, identifying and arranging these collections, and for the opportunity to do this, I must record my deep indebtedness to Prof. W. Boyd Dawkins, Dr. W. E. Hoyle, and the Council of the Manchester Museum.* To these, I added as opportunity served, notes of the specimens in

* Whilst these notes have been passing through the press, I have received the assistance of Mr. S. S. Platt, F.G.S., of Mr. W. Baldwin, F.G.S., who has added several notes of fossils found by him and Mr. W. H. Sutcliffe, F.G.S., at Sparth Bottoms, Rochdale, of Mr. John Gerrard, H.M.I.M., who has paid considrable attention to the sinking at the Bradford Colliery, Manchester, and of Mr. W. Saint, H.M.I.M., who has devoted a considerable amount of time and labour to work connected with this paper.

various private and public museums in the county, and finally I have checked my results by an examination of the whole of the Transactions of the Society from the first volume onwards, and of the Geological Survey Memoirs. As far as possible, with all the species, localities, and horizons mentioned, I have added the name of my authority, or given a reference to the whereabouts of the specimen, and the collection of which it forms a part.

It will be noted that not merely have I recorded known species but also the occurrence of specimens, the species of which have not been determined.

This has been done either because I could not determine the specific identity of the fragments, whilst there was no doubt of the genus, or that I have quoted some authority who did not give the species.

Even without specific identity, the records of these specimens are useful, inasmuch as they indicate the occurrence of certain genera at certain definite horizons. In the present state of our knowledge these unknown species represent determinative work yet to be done. Further research on these horizons, and at these localities, may perhaps prove that no further species have to be added to the list here given, but it is far more likely that other species besides those recorded in this paper will reward the diligent student. The observations made by Mr. George Wild in the Transactions of this Society, Vol. XVII., p. 225, on the nature of the measures in which fossils occur, scarcely needs any addition. Speaking generally, animal fossils are most abundant in the black shales, and less so in the blue shales. The black shales most frequently lie upon the coal seams, often forming the roof, and there seems no question in regard to the Middle Coal Measures at any rate, but that the majority of the animal fossils do occur in close relation to the seams. Between a typical black shale, and an

equally typical blue shale, there is a great lithological difference, implying an equally great difference in origin. The mineral constituents of a black shale are finer, more bituminous and coherent than those of a blue shale, and the latter is often more or less micaceous.

It seems natural to assume that the areas of deposition of black shales were areas of almost stagnant water into which only the finest particles of mineral matter could be carried, and where deposition was very slow.

Probably such areas were lagoon-like in character, possessing an intermittent connection only with freely moving waters, and, bearing in mind their common position over the coal, it may well be that the areas represented portions of the coal forests which had become submerged by greater growth at their edges, blocking the natural drainage and converting the interior into swamps in which the vegetation died, so giving place to extensive shallow lagoons, having a very slight circulation of the contained water.

The presence of the teeth, scales, and defensive spines of the large predatory marine fish of the Coal Measures, such as Megalichthys and Rhizodopsis sufficiently indicate that these areas of deposition were not under fresh water, but possessed at times sea connections.

It must not be lost sight of however, that the Middle Measures do not possess, except in one strange and solitary instance, a clear and strong marine phase. This, the well known, but little understood "Marine Band," seen in the river Tame at Dukinfield, furnishes by its isolation, we think, the most conclusive testimony of a greater development of what may be termed the lagunal phase in the period represented by the Middle Measures, than in that of the Lower series. One other point must be mentioned before we leave the black shales. Where Anthracosia (olim Carbonicola) occur in them, they usually do so in large groups or even

extensive beds such as the "mussel-bands." In the blue shales, they are more sporadic.

In the following pages, the same plan has been adopted as in Part I., viz., the various fossils are enumerated in ascending zoological order, the various horizons and localities of occurrence of each being indicated by reference to specimens or authorities.

The several horizons at which fossils are found are afterwards dealt with and in order to simplify matters, these are arranged under districts. The questions of range of fossils in time and kindred topics are dealt with in the concluding part of the paper.

Vermes.

Examples of worm castings and tracks seem practically unknown, whilst the only species of Spirorbis known appears to have a limited range. This is probably due to neglect in collecting.

Spirorbis pusillus (Martin).

Foot Coal below Fairbottom Mine, Bankfield Clough, Fairbottom. (W. 1838, e. coll. Wild, M.M.)

From roof of Rams Mine at Agecroft sinking. (Stirrup, Trans. Manch. Geol. Soc., Vol. XXVI., p. 95.)

From railway section, Chip Hill, half-a-mile S.E. of Bolton, from 30 yards above the Arley Mine. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 40.)

From between the Bone and Yard Coals in bass at Freeman's Colliery. (Salter in Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Brachiopoda.

The two representatives of this group are restricted to the Marine band of Dukinfield and Audenshaw. As the stratum in which they occur possesses a fauna widely different to the

rest of the Middle Measures, and closely akin to that of the Lower series, whilst it is also purely local, we may regard the Brachiopoda for all practical purposes as non-existent in the fauna of the ordinary strata of the Middle series.

Discina orbicularis (Bolton).

"Marine Band," Ashton Moss Colliery, Audenshaw. (L. 2620, e. coll. Cairns, M.M.)

Lingula sp.

Ashton Moss Colliery, Audenshaw. (e. coll. Cairns, M.M.) No horizon is given with this fossil. Probably L. 3545, 3546 and 3547, e. coll. Cairns, also belong to the same horizon and place but no history is attached to them.

PELECYPODA.

The general character of the molluscan fauna is similar to that of the Lower Measures. The number of genera and species has increased. Eliminating all doubtful forms, we find that eight genera, and twenty species of bivalves are present in the Lower Coal Measures, whilst the Middle possess thirteen genera and thirty-eight species. Four genera and twelve species come up from the Lower into the Middle Measures. The main increase of species is in the three genera Naiadites (Anthracoptera), Carbonicola (Anthracosia), and Anthracomya, the members of which are especially characteristic of the Middle Coal Measures, occur over a wide area, and have a considerable range. The Carbonicola (Anthracosia) are of extreme interest owing to the association of several species at the same horizon, and the great extent of varietal development. Several species can be linked up by means of varietal forms, and there seems no doubt that a considerable amount of interbreeding existed between the forms now regarded as valid species. In the accompanying list, certain forms are

noted as "Modiola," "Orthonota," &c. It has not been possible to identify these as yet with known genera, but as they mark definite localities and horizons it has been thought best to mention them in this paper.

Aviculopecten.

Aviculopecten papyraceous (Sow).

In the "Marine Band." Banks of river Tame at Dukinfield. (Trans. Manch. Geol. Soc., Vol. IV., p. 70.) (Also Prof. Hull, Trans. Manch. Geol. Soc., Vol. III., p. 348.)

Aviculopecten fibrillosus (Salter).

Found in the "Marine Band" of the Middle Coal Measures on the banks of the river Tame at Dukinfield (e. coll. Cairns, M.M.). The "Marine Band" is placed by Salter about 150 yards above the Great Mine. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

Aviculopecten Cairnsii (Bolton).

Found in the "Marine Band" of the Middle Coal Measures on the banks of the river Tame at Dukinfield. (L. 3544, 3549, and 3550, e.coll. Cairns, M.M.)

Avicula tenua (Brown).

From above the Arley Mine at Duxbury Colliery. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

"*Modiola.*"

In blue shale below the Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

From dark shale over the Low Bottom Bed at Fulledge Colliery. (Op. cit., p. 184.)

From black shale over 5½ inch coal, 75 yards below the New Mine, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 446.)

A few specimens in black shale roof over the Five and a half-inch coal at 636 yards, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 462.)

In blue shale below the Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

From dark shale over the Low Bottom Bed at Fulledge Colliery, Burnley. (Op. cit., p. 184.)

NAIADITES (olim ANTHRACOPTERA).

Naiadites modiolaris (Sow).

From the Stubbs Mine, Ashton-under-Lyne. (Dr. Hind, Pal. Soc. Monog. Carbonicola, &c., p. 133.)

Naiadities quadrata (Sow).

From the Middle Coal Measures of Prestolee, horizon not stated. (L. 3256, e. coll. Roeder, M.M.)

From the Stubbs Mine, Bardsley Colliery (W. 619, e. coll. Wild, M.M.).

Naiadites Browniana (Salter).

In impure cannel, black bass and ironstone at Pendleton and Agecroft Colleries. Binney, Trans. Manch. Geol. Soc., Vol. IV., p. 220. The horizon is probably that mentioned by Salter in the Geol. Surv. Mem., Geology of Country around Bolton-le-Moor, p. 41, namely, the Four Foot Mine of Pendleton.

From Vitriol Works, two miles S.E. of Bolton, no horizon stated. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

As "Avicula Browniana" from the Three Yards' Mine (Albert and Crumbouke Mines?) at Leadbetter Fold, Little Lever, Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.) (Salter, op. cit., p. 41.)

Between the Bone and Yard Coals in dark bass at Freeman's Colliery, Copall. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Naiadites triangularis (Sow).

From the Middle Coal Measures of Burnley, horizon not stated. A specimen in the Kay-Shuttleworth collection at the Manchester Museum.

Naiadites carinata (Sow).

From the Fairbottom Mine of Hill Pit (Bardsley) (W. 615, e. coll. Wild, M.M.)

Also from the Fairbottom Mine of Knott Lane, (W. 616, e. coll. Wild, M.M.).

Naiadites elongata (Hind).

From the ironstone band in the Middle Coal Measures, Prestolee. (Dr. Hind, Pal. Soc., Monog. Carbonicola, &c. Explanation to pl. XVIII., fig. 22.)

Naiadites sp.

A specimen from Alkrington Colliery, Middleton, is in the Wild Collection (W. 622) of the Manchester Museum. It is labelled, "Found in sinking tip."

Two other specimens, the species of which I have not been able to determine, are from the Five and a half-inch coal of Bardsley (W. 596, e. coll. Wild, M.M.) and from the Nield Mine of Bardsley (W. 617, e. coll. Wild, M.M.).

From the Yard Mine at Hulton Colliery, three miles S.W. of Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

From 30 yards above the Arley Mine in railway section, Chip Hill, half-a-mile S.E. of Bolton. Salter op. cit., p. 41. "Thin oblique species" from the Ten Feet Mine (White and Black seams) at Lomax Fold, Little Lever, Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

From the Cannel Mine at Moss House, $3\frac{1}{2}$ miles S.W. of Bolton. (Salter, op. cit., p. 40.)

From the Three Yard Mine at Hulton Colliery, 3 miles S.W. of Bolton. (Salter, op. cit., p. 40.)

From the Black Mine at Mill Lane, 3 miles N.E. of Stockport. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

Chœnocardiola Footi.

From the Coal Measures of Burnley. (Recorded by Dr. Hind, Pal. Soc., Monog. Carbon. Lamell, p. 475.)

Ctenodonta sp.

From over the Great Mine at Ashton-under-Lyne. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

Tellinomya robusta (Bolton).

This species is remarkable for its constant occurrence in the roof of the cannel coal over the whole of the Bolton district. It first came to the notice of the writer in the collections made by members of the Geological Society, and forwarded to the Manchester Museum by Mr. Mark Stirrup and Mr. James Tonge, senior. The species was figured and described by the writer in the Manchester Memoirs of the Lit. and Phil. Soc., Vol. XLI., No. 6 (1897).

From the Cannel Mine of Watergate Colliery, Middle Hulton. (L. 3493, M.M.)

From the Cannel Mine of Hulton Park, Bolton. (W. 623 e. coll. Wild, M.M.)

From the Cannel Mine of Worsley Tunnel. (M.M.)

From the Cannel Mine of Tyldesley. (L. 1049, M.M.)

From the Cannel Mine of Bank Colliery. (L. 1052, M.M.)

From the Cannel Mine of Chequerbent, Bolton. (L. 1058, M.M.)

From the Cannel Mine of Mill Hill Bleach Works. (L. 3331, M.M.)

Tellinomya n. sp.

Three specimens of what I believe to be an undescribed species from the Cannel Mine of Watergate Colliery are in the Manchester Museum. (L. 3332, M.M.)

Nucula lævirostrum (*Portlock*).

From over the Great Mine at Ashton-under-Lyne. (Dr. Hind, Pal. Soc., Monog. Carbon. Lamell., p. 184.)

Schizodus sp.

From Worsley, no horizon stated. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

Carbonicola (olim Anthracosia).

Carbonicola robusta (Sow).

An interesting suite of specimens of this species are in the Wild Collection of the Manchester Museum, having been obtained from about six inches over the Five and a half-inch coal in the Diamond shaft, Bardsley. The coal occurs at 636 yards from the surface. The interest of the specimens lie in the fact that they show varietal development, which would seem to indicate that they merge on the one hand into Carbonicola acuta, and on the other into the more typical C. robusta, such as is found at Burnley.

Typical forms of C. robusta are found in the roof shales of the Lower Yard Bed, Fulledge Colliery, Burnley. (W. 511 and W. 512, e. coll. Wild, M.M.)

From the Bastard Cannel at 16 yards in the Fulledge Colliery, Burnley. (W. 515, e. coll. Wild, M.M.)

From the "Mussel-bed" of the Pendleton Colliery. Examples in the Manchester Museum.

From the Middle Coal Measures of Hulton, near Bolton. (e. coll. Tonge, M.M.)

From the Arley Mine at Gidlow Colliery, Standish. (L. 1053, M.M.) Collected by Mr. Higson.

From the roof of the Cannel or Two Feet Mine at Dukinfield. (W. 521, e. coll. Wild, M.M.)

In the roof of uppermost 6 inches at Fulledge Colliery, Burnley. (George Wild, Trans. Manch., Geol. Soc., Vol. IV., p. 183.)

As "Unio robustus" from 200 yards above the Habergham or assumed Arley Mine at Fulledge. (Binney in "Excursion to Burnley," Trans. Manch. Geol. Soc., Vol. II., p. 51.)

As Unio robustus from 47 yards above the Arley Mine at Wigan. (Binney in "Excursion to Burnley," Trans. Manch. Geol. Soc., Vol. II., p. 51.)

As Anthracosia robusta in black shale roof over the Five and a half-inch coal at 636 yards. Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 462.)

From 30 yards above the Arley Mine in railway section, Chip Hill, half-a-mile S.E. of Bolton. (Salter, Geol. Surv. Mem. Geology of Conntry around Bolton-le-Moors, p. 41.)

Carbonicola acuta (Sow).

From roof shales above the New Mine, Bardsley. Five-and-a-half inches above the coal. (W. 528, e. coll. Wild, M.M.)

Fifteen inches above the coal, some horizon. (W. 533, e. coll. Wild, M.M.).

Thirty to thirty-six inches above the coal, same horizon. (W. 535, e. coll. Wild, M.M.)

In Bastard Cannel associated with Ostracods, Nield Mine, Glodwick, Oldham. (W. 537, e. coll. Wild, M.M.) Curiously elongated valves approaching *C. aquilina.*

Roof of the Orrel five-feet mine at Wigan. (L. 3320, M.M.)

From the Middle Coal Measures of Kersley, horizon not stated. Specimens in the Manchester Museum.

In Bastard Cannel under the Trencherbone seam at St. George's Pit, Tyldesley, associated with *Rhizodopsis sauroides.*

From Ashton Moss Colliery, Audenshaw, horizon not stated. (L. 3532, e. coll. Cairns, M.M.)

From the Cannel Mine, Moss House, 3½ miles S.W. of Bolton. (Salter, Geol. Surv. Mem. Geology of Country around Bolton-le-Moors, p. 41.)

From the Five Quarters Mine at Lomax Brow, Peel, 4 miles south of Bolton. (Salter, op. cit., p. 41.)

From Alkington, Middleton, no horizon stated. (Salter, op. cit., p. 41.)

From 30 yards above the Arley Mine in railway section, Chip Hill, half a mile S.E. of Bolton. (Salter, op. cit., p. 41).

From the Three Yard Mine of Hulton Colliery, 3 miles S.W. of Bolton. (Salter, op. cit., p. 41.)

From the Black Mine at Dukinfield. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

From Sparth Bottoms, Rochdale, between the Neddy and Royley Mines, about 60 yards above the latter. (Baldwin, Trans. Manch. Geol. Soc., Vol. XXVII., p. 152.)

From Sparth Bottoms, at about 45 yards above the Royley Mine. (Baldwin, Trans. Manch. Geol. Soc., Vol. XXVIII., p. 198.) Specimens in Rochdale Museum.

Carbonicola acuta, var ovalis (Martin).

Brassey Mine of Tyldesley. Specimens in Manchester Museum.

From the Middle Coal Measures of Middleton, horizon not stated, M.M.

From the Californian or Thin Bed of Burnley. (W. 561, e. coll. Wild, M.M.)

From the New Mine of Bardsley Colliery. (W. 564, e. coll. Wild, M.M.)

As "Anthracosia ovalis" from the Ashclough or Bin Coal at Shore top, one mile S.E. of Little Lever. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

As "Anthracosia ovalis" from the Three Yard Mine at Lomax Fold, Little Lever, Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors p. 41.)

From the Seven Feet or Rams Mine at Pendleton Colliery. (Salter, op. cit. p. 41.)

From above the Trencherbone seam at Green near Bolton. (Salter, op. cit. p. 41.)

From the Cannel Mine at Moss House, 3½ miles west of Bolton. (Salter, op. cit. p. 41.)

From the Thin Mine, (Californian, H.B.) of Kaysand Ford, Burnley. (W. 562, e. coll. Wild, M.M.)

From the Black Mine of Nat Bank. (Salter, Geol. Surv. Mem., Geology of Country around Oldham p. 63.)

From the Black Mine of Mill Lane, 3 miles N.W. of Stockport. (Salter, op. cit. p. 63.)

From the Black Mine at Dukinfield. (Salter, op. cit. p. 63.)

As "Anthracosia ovata" recorded as follows:—In blue shale below the Cannel Coal at 162 yards. Fulledge Colliery Burnley. (Geo. Wild, Trans. Manch. Geol. Soc. Vol. IV. p. 184.)

As "Anthracosia centralis" from the Three Yard Mine at Hulton Colliery, 3 miles S.W. of Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors p. 41.)

As "Anthracosia centralis" from the Cannel Mine at Moss, House, 3½ miles S.W. of Bolton. (Salter, op. cit. p. 41.)

Carbonicola acuta, var rhomboidalis (Hind).

From the Middle (?) Coal Measures of Burnley. (L. 2866 e. coll. Kay-Shuttleworth, M.M.)

Carbonicola rugosa (Brown).

A specimen of these species is recorded by Dr. Hind from Cant Clough near Burnley, and the horizon as doubtful.

I am strongly inclined to think that the specimens recorded as C. rugosa and which are all more or less eroded, will yet prove to be examples of C. robusta.*

The specimen from Cant Clough, figured by Dr. Hind in his monograph on Carbonicola, pl. II. fig. 7, is much more likely to be from the Middle or Lower Coal Measures than from the Yoredales.

Carbonicola nucularis (?) (Hind).

From the Stubbs Mine at Bardsley. (W. 542, e. coll. Wild, M.M.)

From "Mountain Mine" of Wigan. (Dr. Hind, Pal. Soc., Mong. on Carbonicola, &c,, p. 63.)

Carbonicola aquilina (Sow).

From over the Stubbs Mine at Bardsley Colliery. (W. 545-550 e. coll. Wild, M.M.)

From 12 inches above the Stubbs Mine at Banksfield Tunnel, Bardsley. (W. 555., e. coll. Wild, M.M.†)

From the Yard Coal at Old Hall, three-quarters of a mile S.W. of Little Lever. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

From the Cannel Mine at Moss House, 3½ miles S.W. of Bolton. (Salter, op. cit., p. 41.)

From the Ashclough or Bin Coal at Shoretop, one mile S.E. of Little Lever. (Salter, op. cit., p. 41.)

* Since writing the above I have found the following note: "It appears to me, judging from all the specimens I saw at Manchester, certain that A. rugosa of Brown is the same species," *i.e.*, A. robusta. (Salter, Geol. Surv., Mem., Geology of Country around Wigan, p. 36.)

† These seven specimens are of special interest as they were found in association with 13 specimens of C. turgida, in nine square inches of space. The growth of various species of Carbonicola in close association will probably be found to have an important bearing upon the validity of several forms now regarded as distinct species, the more so because in any large collection of Carbonicola, it is easily possible to arrange gradational series between two and even more species. This is especially true of the species, C. acuta, C. aquilina, and C. turgida, and the sub-species of C. acuta, all of which are linked up by intermediate varietal forms.

From the Three Yard Mine at Hulton Colliery, three miles S.W. of Bolton. (Salter, op. cit., p. 41.)

From ten inches above the Stubbs Mine at Bardsley. (W. 655, e. coll. Wild, M.M.)

From the Stubbs Mine at Ashton-under-Lyne, associated with C. acuta, var ovalis, and a species of Naiadites (Anthracoptera.) (W. 560, e. coll. Wild, M.M.)

From the Stubbs Mine of Betony Brow, Bardsley. (W. 522, e. coll. Wild, M.M.)

From a depth of 300 to 350 yards in shaft of Ashton Moss Colliery. (W. 558, e. coll. Wild, M.M.)

From the Seven Feet Mine of Linnyshaw Colliery. (L. 1054, M.M.)

From the Brassey Mine of Tyldesley. Specimens in the Manchester Museum.

From the Rams Mine of Tyldesley. (L. 1059, M.M.)

From the New Mine at Bardsley. (Recorded by Dr. Hind, Pal. Soc., Monog. Carbonicola, &c., p. 75.)

Carbonicola obtusa (Hind).

From over the Trencherbone seam at Kersley Colliery. (L. 1048, M.M.)

From the Middle Coal Measures of Hindley. (M.M.)

From the Black Mine of Ashton Moss Colliery, Audenshaw. (W. 541, e. coll. Wild, M.M.)

Carbonicola subconstricta (Sow).

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 563 and W. 565, e. coll. Wild, M.M.) These specimens are internal casts which were labelled as A. ovalis by Wild, and figured by Dr. Hind as Carbonicola subconstricta. It would be interesting if these casts could be compared with similar internal casts of C. robusta.

From the Wigan Nine-feet Mine of Ince, near Wigan. (L. 1041 and L. 1052, M.M.)

From the Middle Coal Measures of Hindley, horizon not stated.

Carbonicola subrotunda (Brown).

From Nield Mine of Bardsley, associated with Beyrichia. (W. 544, e. coll. Wild, M.M.)

Carbonicola turgida (Brown).

From the Black Mine of Ashton Moss Colliery. (W. 576, e. coll. Wild, M.M.)

From the Stubb's Mine of Banksfield Colliery, Bardsley. (W. 568, e. coll. Wild, M.M.)

From 12 inches above the Stubb's Mine at Banksfield Tunnel, Bardsley. (W. 575, e. coll. Wild, M.M.*)

From the Stubbs Mine at Bardsley Colliery. (W. 566 and W. 1218, e. coll. Wild, M.M.) The latter (W. 1218) is associated with a spine of Gyracanthus formosus.

Carbonicola similis (Brown).

From the Nine-inch Coal at 622 yards, Bardsley Colliery. (W. 582, e. coll. Wild, M.M.)

Carbonicola angulata (de Ryckholt).

From the Low Bottom Bed of the Fulledge Colliery, Burnley (W. 588, e. coll. Wild, M.M.) Specimens from this horizon and locality are figured by Dr. Hind, Pal. Soc., Monog. Carbonicola, &c. pl. XI., figs. 3, 4.

Carbonicola sp. indet.

From 15 inches above the New Mine at Bardsley Colliery (W. 530, e. coll. Wild, M.M.)

From soapy stone, over the nine-inch coal at 621 yards, Bardsley Colliery. (W. 599, e. coll. Wild, M.M.)

From the roof of the Black Mine at Bardsley. (W. 591, e. coll. Wild, M.M.)

From the Nield Mine of Bardsley. (W. 657, e. coll. Wild, M.M.)

* Some specimens from the roof of the Stubbs Mine are very short and rounded and show a tendency to pass into C. ovalis.

From roof of the Black Mine, Ashton Moss Colliery.

From roof of the Fairbottom Mine at Hill Colliery. (W. 594, e. coll. Wild, M.M.)

In roof of the Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

From dark shale over the Low Bottom Bed at Fulledge Colliery, Burnley. (Op. cit., p. 184.)

In shale over the Great Mine, Fulledge Colliery, Burnley. (Op. cit., p. 185.)

Two species at two feet above a nine-inch coal at 622 yards deep, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 461.)

From inferior Cannel called the "Lower Cannel" at 525 yards from surface. Section at Bardsley Colliery. (Op. cit., p. 458.)

A few flattened forms at 27 yards below Old Mine at Bardsley Colliery. (Op. cit., p. 460.)

Fifteen inches and 36 inches above New Mine at Bardsley Colliery. (Op. cit., p. 446.)

In dark blue soapy stone over nine-inch coal, Bardsley Colliery. (Op. cit., p. 446.)

Two beds of Anthracosia at 15 yards below Old Mine at Bardsley Colliery. (Op. cit., p. 459.)

In black shale below the Lower Cannel at 525 yards, Bardsley Colliery. (Op. cit., p. 458.)

Anthracosia sp., distinct from A. aquilina, from the Ten Foot Mine at Lomax Fold, Little Lever, Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

From the Black Mine at Mill Lane, three miles N.W. of Stockport. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

Edmondia, short sp.

From Worsley tunnel, no horizon stated. (Salter, Geol. Surv. Mem. Geology of Country around Bolton-le-Moors, p. 41.)

Orthonota sp.

From Fulledge Colliery, Burnley, at 15 yards deep. (W. 653, e. coll. Wild, M.M.)

From dark shale over the Low Bottom Bed at Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

Anthracomya Wardi (Salter).

From the Middle Coal Measures of Burnley, horizon not known. (L. 2070, e. coll. Kay-Shuttleworth, M.M.)

From Bastard Cannel over the Low Bottom Bed of the Fulledge Colliery, Burnley. (L. 2071 and 2069, e. coll. Kay-Shuttleworth, M.M.)

From the Low Bottom Bed, Fulledge Colliery, Burnley. (W. 602, e. coll. Wild, M.M.)

Anthracomya modiolaris (Sow).

From the Fairbottom Mine at Hill Colliery. (W. 612, e. coll. Wild, M.M.)

From the Stubbs Mine at Bardsley Colliery. (W. 608 and 609, e. coll. Wild, M.M.) Associated with C. aquilina and C. turgida.

From the Black Mine of Oldham. (Recorded by Dr. Hind, Pal. Soc. Monog., Carbonicola, &c., p. 96.) Also recorded by Salter from the same horizon. (Salter, Geol. Surv. Mem. Geology of Country around Oldham, p. 63.)

Anthracomya dolabrata (Sow).

From the Stubbs Mine of Bardsley. (W. 605, e. coll. Wild, M.M.)

From the Great Mine of Bardsley, associated with Carbonicola. (W. 613, e. coll. Wild, M.M.)

From the Black Mine of Oldham. (Recorded by Dr. Hind, Pal. Soc. Monog., Carbonicola, &c., p. 94; also recorded by Salter from the same horizon. Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

Anthracomya minima (Ludwig).

Recorded from the Middle Coal Measures of Prestolee by Dr. Hind, Pal. Soc. Monog., Carbonicola, &c., p. 117 (e. coll. Roeder, M.M.).

Anthracomya minima, var. carinata (Hind).

From the Middle Coal Measures of Prestolee. (L. 3255, e. coll. Roeder, M.M.)

Anthracomya lævis, var. Scotica (Dawson).

Roof of the Cannel Coal, Wigan. (Recorded by Dr. Hind, Pal. Soc. Monog., Carbonicola, &c., p. 124.)

From the Middle Coal Measures of Burnley. (L. 2074 and 2072, e. coll. Kay-Shuttleworth, M.M.)

From the Low Bottom Bed of the Fulledge Colliery, Burnley. (W. 661, e. coll. Wild, M.M.) This is possibly a new species. Also from this locality and horizon. (W. 611, e. coll. Wild, M.M.)

From the Stubbs Mine of Bardsley, Lancs. associated with C. aquilina and C. turgida. (W. 610, e. coll. Wild, M.M.)

Anthracomya sp.

From above the Trencherbone Coal at Green, near Bolton, on the river Irwell. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

GASTEROPODA.

This group is represented by three genera, of unknown species.

Pulmoniferous gasteropods (Spiroglyphus).

From Sparth Bottoms, Rochdale. (Baldwin, Trans. Manch. Geol. and Min. Soc., Vol. XXVIIII, Part XVII.)

Serpulites, wavy sp.

From over the Great Mine at Ashton-under-Lyne. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

Turitella sp.

Marine Band, Dukinfield. (M.M.)

Cephalopoda.

Representatives of this division seem entirely absent from the Middle Coal Measures if we except the remarkable "Marine Band," at Dukinfield and Ashton Moss Colliery, Audenshaw. A number of specimens mainly, I believe, collected by Mr. R. Cairns, of Ashton-under-Lyne, are in the Manchester Museum, but cannot be identified; Salter has described one species of Discites, and indicated the existence of two more. From this horizon also, Mr. J. W. Salter recorded the following:—

Nautilus precox (Salter).
Goniatites sp. inc.
Discites rotifer (Salter).
Discites sp.
Discites sp.
Orthoceras, thin sp.

All these species are also stated to occur over the Great Mine at Ashton-under-Lyne. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

Crustacea and Myriopoda.

These groups include no less than five genera of considerable interest, in addition to Ostracods. One rare form, Limulus trilobitoides, seems to have been wholly lost until re-discovered by Mr. Walter Baldwin, F.G.S., at Sparth Bottoms near Rochdale.

The presence of such crab-like forms as Cyclus, Limulus, and Prestwichia has hardly been suspected in the Middle

Coal Measures, or closer search would have been made for more of them.

The two species of Euphoberia, and an unknown species of Xylobius belong to the Myriopoda, a group not usually supposed to be represented in the Lancashire coalfield.

Beyrichia arcuata (Bean).

Low Bottom Bed at Fulledge Colliery, Burnley. (W. 507, e. coll. Wild, M.M.)

From the *Six Quarters Mine at Lomax Brow, Peel, four miles south of Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 40.)

From above the Doe Coal at Stone Clough, near Farnworth. (Salter, op. cit., p. 40.)

Beyrichia Binneyana (Jones).

From Rainford. No horizon. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Cytheropsis sp.

From Rainford. No horizon stated. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

(*? Cypris.*)

From dark shale over the Low Bottom Bed at Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

Estheria striata, (Munster).

From two places in Lancashire, in Cannel coal of the Middle Coal Measures. (Prof. Rupert Jones, Pal. Soc. Mon., Fossil Estheriæ, p. 24.)

From the Cannel at Moss House, Wigan. (Salter, in Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

* Probably the Five Quarter Mine is meant.

Estheria striata, var. Beinertiana (Jones).

This variety was found by Mr. E. W. Binney in Mr. Hulton's Cannel Coal at Hulton Lane Ends, near Bolton-le-Moors. Also at Moss House, 2½ miles south-west of Bolton. (Salter.)

Also from the Cannel Coal at Ince, near Wigan. (Binney.)

Estheria sp

From Royley (Arley) Mine at Nat Bank. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

* *Belinurus bellulus* (Konig) (*olim Limulus trilobitoides*).

From Oldham, no horizon stated. The original specimen was deposited in the Natural History Museum, Manchester, but has disappeared. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

From 135 feet above Royley (Arley) Mine at Sparth Bottoms, Rochdale. (Baldwin and Sutcliffe, Abstract of Proceedings, Geol. Soc., London, No. 794, p. 81. Also Trans. Manch. Geol. Soc., Vol. XXVIII., p. 198. The specimen is now in the Rochdale Museum, e. coll. Baldwin and Sutcliffe.)

Prestwichia rotundata (Prestwich).

From shale below the Doe Mine on the banks of the Irwell at Clifton Hall. (P. 812, e. coll. Dawkins, M.M.)

From shale behind the fossil tree trunks at Dixon Fold, on the Lancashire and Yorkshire Railway.

Found by Mr. J. W. Croston. (L. 2785 M.M.)

From below the Neddy Mine and probably about 60 yards above the Royley or Arley Mine. (Baldwin., Trans. Manch. Geol. Soc., Vol. XXVII., p. 149.)

From 135 feet above the Royley (Arley) Mine at Sparth Bottoms, Rochdale. (Baldwin & Sutcliffe's Abstract of

* Dr. F. A. Bather suggests that this specimen ought to be called *Bellinurus lunatus* (Martin), having been described by Martin in his "Petrificata Derbiensia," published in 1809.

Proceedings, Geol. Soc. London, No. 794, p. 81. Also Trans. Manch. Geol. Soc., Vol. XXVIII., p. 198.)

Cyclus Johnsoni.

From roof of the Fairbottom Mine at Bardsley. Two halves of nodule showing rim of carapace. (W. 1223, e. coll. Wild, M.M.)

Arthropleura (*olim Eurypterus*) *mammatus* (Salter).

This species was described from fragments referred to the head, the lateral portions of the body segments, and parts near the tail, found at the pit top of Pendleton Colliery by Messrs. Gibbs & Rhind, and the collectors of the Geological Survey. Quart. Journ. Geol. Soc., Vol. XIX., p. 85. The exact horizon was found to be the "Ferny Metal" under the "Big Coal" or Rams Mine, which is also styled the "Seven-foot Coal," by Salter, op. cit., p. 86.

Pygocephalus Cooperi (Huxley).

From coal shale at Medlock Park Bridge, Ashton-under-Lyne. A remarkable form found by Mr. Cooper of Bilston, and described by Professor Huxley, Quart. Jour. Geol. Soc., Vol. XIII., p. 363. Type specimen in the Manchester Museum. Salter states that the specimen was probably from the Black Mine. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 63.)

From Sparth Bottoms between the Neddy and Royley Mine at about 60 yards above the latter. The specimen is in the Rochdale Museum.*

ARACHNIDA.

Eoscorpius Sparthensis (Baldwin).

From 135 feet above the Royley (Arley) Mine at Sparth Bottoms, Rochdale. (Baldwin & Sutcliffe, Abstract of

* I have recently had an opportunity of examining Mr. Baldwin's specimen, and am of opinion that it is more nearly related to Anthrapalæmon than to Pygocephalus. It is in all probability a new species of the former genus.

Proceedings, Geol. Soc. London, No. 794, p. 81.) (L. 6271, e. coll. Baldwin, M.M.)

Myriopoda.

Euphoberia Browni (Woodward).

From shale behind the fossil tree trunks at Dixon Fold on the Lancashire and Yorkshire Railway. (p. 813, e. coll. Dawkins, M.M.)

Euphoberia ferox (Salter).

Found amongst a collection of specimens collected at the pit top, Pendleton colliery, by Messrs. Gibbs and Rhind. Dr. H. Woodward, "Pal. Soc. Mon., British Fossil Crustacea." Specimen in the Jermyn Street Museum. The exact horizon was afterwards proved to be the "Ferny metal" under the "Big coal," or Rams Mine. (Quart. Journ. Geol. Soc., Vol. XIX., p. 86.)

From Sparth Bottoms, Rochdale, 45 yards above the Royley Mine. The specimen is in the Rochdale Museum, and is represented by a few segments.

Xylobius sp.

A specimen from the Ashton Moss Colliery at Audenshaw is referred by me to this genus, but the species is indeterminable. It is in the Cairns collection of the Manchester Museum.

Insecta.

This group is represented by an imperfect specimen of a Neuropterous insect from 47 yards above the Royley Mine at Sparth Bottoms, Rochdale, and a doubtful larval form of Etoblattina from about 60 yards above the Royley Mine at the same place. Both specimens are in the Rochdale Museum. (Baldwin, Trans. Manch. Geol. & Mining Soc., Vol. XXVIII., Part XVII.)

Pisces.

Fishes may be said to have dominated the Middle Coal Measure period, as no less than 40 species are known, belonging to 25 genera.

The Lower Coal Measures have only yielded 17 species belonging to 13 genera, and of these no less than 12 species and 10 genera live on into the Middle Coal Measures.

A remarkable feature in connection with the occurrence of fish remains is their prevalence in the roof shales of coal seams, or in the case of Cannel, in the coal itself. Wherever a black shale lies upon a coal seam, there fish teeth and scales may be looked for with a considerable likelihood of success. Very rarely are fishes found whole, more usually they are represented by teeth, isolated scales and defensive spines.

Diplodus gibbosus (Binney).

From 400–500 yards deep at Ashton Moss Colliery, Audenshaw. (L. 2591 and L. 2599, e. coll. Cairns, M.M.)

From Fulledge Colliery, Burnley. Horizon not known. (e. coll. Kay-Shuttleworth, M.M.)

From the Cannel Seam of Wigan. (e. coll. Bowman, M.M.)

From the Middle Coal Measures of Peel, Little Hulton. Horizon not known (M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 907 and 902, e. coll. Wild, M.M.)

From shale below the Stubbs Mine at Bardsley. (W. 901, e. coll. Wild, M.M.)

From eight yards above the Old Mine at Bardsley. (W. 904, e. coll. Wild, M.M.)

From the Nield Mine of Glodwick, Oldham. (W. 1203, e. coll. Wild, M.M.)

From Bispham Colliery. (Salter, Geol. Survey. Geology of the Country around Wigan, p. 35.)

From the black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

The following specimens differ in some particulars from the typical form of Diplodus gibbosus, but are probably referable to that species:—

From the Cannel Seam of Wigan, marked "sp. n. (A.S.W.") Specimen in Manchester Museum.

From the Stubbs Mine at Bardsley Colliery. (W. 1850, e. coll. Wild, M.M.)

From the Two Feet Mine at Bardsley Colliery, associated with *Strepsodus sauroides*. (W. 809, e. coll. Wild, M.M.)

From the Californian or Thin Bed of Burnley. (W. 1848, e. coll. Wild, M.M.)

Diplodus tenuis (Woodward).

From Ashton Moss Colliery, Audenshaw. Horizon not known. (L. 2590, e. coll. Cairns, M.M.)

Diplodus sp.

In roof of Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

In shale over Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

Pleuracanthus lævissimus (Agassiz).

From the Californian or Thin Bed of the Fulledge Colliery, Burnley. (W. 911, e. coll. Wild, M.M.)

From the Two Feet Mine of Bardsley. (W. 912, e. coll. Wild, M.M.)

From the Arley Mine of Burnley. (W. 910, e. coll. Wild, M.M.)

Pleuracanthus alatus (Davis).

From the Arley Mine, probably of Burnley. (W. 915, e. coll. Wild, M.M.) Labelled "Spine of selachian fish."

Pleuracanthus cylindricus (Davis).

From the Middle Coal Measures of Fulledge Colliery, Burnley. (L. 2175, e. coll. Kay-Shuttleworth, M.M.)

From the Middle Coal Measures of Peel, Little Hulton. (M.M.) No horizon known in either case.

Pleuracanthus undulatus (Davis).

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (L. 1620, e. coll. Kay-Shuttleworth, M.M.)

Same locality and horizon. (e. coll. Wild, M.M.)

Pleuracanthus erectus (Davis).

From the Two Feet Mine of Bardsley. (W. 916, e. coll. Wild, M.M.)

Pleuracanthus serratus (Davis).

From the Middle Coal Measures, probably of Burnley. No horizon stated. (L. 2323, e. coll. Kay-Shuttleworth, M.M.)

Pleuracanthus denticulatus (Davis).

From the Two Feet Mine of Bardsley. (W. 913, e. coll. Wild, M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 914, e. coll. Wild, M.M.)

Pleuracanthus sp. indet.

From the Nield Mine of Glodwick, Oldham (W. 1106, e. coll. Wild, M.M.)

In Shale, over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

From the Two Feet Mine of Bardsley. (W. 912, e. coll. Wild, M.M.)

Ctenoptychius apicalis (Agassiz).

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 875, e. coll. Wild, M.M.) Associated with *Pleuroplax Rankinei*.

From the same locality and horizon. (W. 878 and W. 884, e. coll. Wild, M.M.) Associated with *Callopristodus pectinatus.*

From Ashton Moss Colliery, Audenshaw, at 400-500 yards deep. (L. 2605, e. coll. Cairns, M.M.)

From the Middle Coal Measures of Burnley. Horizon not stated. (L. 2216, e. coll. Kay-Shuttleworth, M.M.) Associated with Rhizodontoid vertebræ.

From the Arley Mine at Fulledge Colliery, Burnley. (W. 1853, e. coll. Wild, M.M.)

From shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

Ctenoptychius sp.

In the Cannel Mine at Haigh. (Binney, Trans. Manch. Geol. Soc., Vol. I., p. 157.)

From the Cannel of Wigan. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Callopristodus pectinatus (Agassiz).

From the Californian or Thin Bed of Burnley. (W. 884 and 878, e. coll. Wild, M.M.) Associated with *Ctenoptychius apicalis.*

Same locality and horizon. (W. 1069, e. coll Wild, M.M.) Associated with *Acanthodes.*

From eight yards above the Old Mine at Bardsley. (W. 1081, e. coll. Wild, M.M.)

From the Middle Coal Measures of Ashton Moss Colliery, Audenshaw. (e. coll. Cairns, M.M.) Horizon not stated.

As "Ctenoptychius pectinatus." In shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

As "Ctenoptychius pectinatus." From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

Helodus simplex (Agassiz).

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 893, e. coll. Wild, M.M.) Probably L. 2319 and L. 2321 in the Kay-Shuttleworth collection of the Manchester Museum are from the same horizon at Fulledge colliery, although this is not stated.

From the Arley Mine of Fulledge Colliery, Burnley. (W. 892, e. coll. Wild, M.M.)

Pleuroplax (olim Pleurodus) Rankinei (Hancock & Atthey).

From the foot coal below Fairbottom Mine at Pickford Wood Colliery. (W. 1839, e. coll. Wild, M.M.)

From the Two Feet Mine of Bardsley Colliery. (W. 1855, e. coll. Wild, M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 934, e. coll. Wild, M.M.)

From over a coal seam at 530 to 531 yards deep in the Victoria shaft, Bardsley. (W. 933, e. coll. Wild, M.M.)

From the Two Feet Mine of Burnley. (W. 928, e. coll. Wild, M.M.)

From the Arley Mine of Fulledge Colliery, Burnley. (W. 925, e. coll. Wild, M.M.)

From the "Calamite bed" at 640 yards, Bardsley Colliery. (W. 900, e. coll. Wild, M.M.) This specimen is a tooth of abnormal size, being about one inch long, and half-an-inch broad and high. A similar tooth is in the Kay-Shuttleworth collection, and bears the register number L. 1700.

From 400–500 yards deep in shaft of Ashton Moss Colliery, Audenshaw. (L. 2604, e. coll. Cairns, M.M.)

From Fulledge Colliery, Burnley, probably from the Californian or Thin Bed. (L. 1699, e. coll. Kay-

Shuttleworth, M.M.) Associated with a small fish spine of the Sphenacanthus type, and similar to those described as *Hoplonchus elegans* by the late J. W. Davis. (Quart. Journ. Geol. Soc., Vol. XXXV., p. 181.)

From over a half-inch coal at 604 yards at Bardsley. (W. 930, e. coll Wild, M.M.)

From the Middle Coal Measures of Oldham, horizon not stated. (e. coll. Williamson, M.M.)

From over seven-inch Bastard Cannel in the Diamond Shaft, Bardsley. (W. 932, e. coll. Wild, M.M.) Associated with *Megalichthys Hibberti.*

(W. 1079, e. coll. Wild, M.M.) From the same horizon and locality is associated with shagreen.

Pleuroplax Attheyi (Barkas).

From the Middle Coal Measures of Ashton Moss Colliery, Audenshaw. Horizon not stated. (L. 2603, e. coll. Cairns, M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 1854, e. coll. Wild, M.M.)

Pleuroplax sp.

In shale over the Great Mine, Fulledge Colliery, Burnley. (Geo. Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

In shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (Op. cit., p. 185.)

In shale over the Two feet Mine at 475 yards from surface, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 457.)

Roof of half-inch coal at 18 yards above a nine-inch coal, the latter at 622 yards deep, Bardsley Colliery. (Op. cit., p. 461.)

Roof of nine-inch coal at 622 yards deep, Bardsley Colliery. (Op. cit., p. 461.)

In black stone roof over seven-inch inferior Coal, the latter at 646 yards deep, Bardsley Colliery. (Op. cit., p. 462.)

From 78 yards below the New Mine, Bardsley Colliery. (Op cit., p. 446.)

In Bastard Cannel at 617 yards deep, Bardsley Colliery. (Op. cit., p. 463.)

Psephodus magnus (McCoy).

From over the Arley Mine at Burnley. (Recorded by Capt. J. Aitken in one of the earlier volumes of the Society's Transactions.)

Sphenacanthus hybodoides (Egerton).

This species is represented by spines and teeth.

From the Low Bottom Bed of Whittlefield Colliery. (L. 2185, e. coll. Kay-Shuttleworth, M.M.) Spine.

From the Pomfret Mine of Bardsley. (W. 1516, e. coll. Wild, M.M.) Fragment of spine in block of Cannel coal.

From the Arley Mine of Rowley Colliery, Burnley. (W. 935, e. coll. Wild, M.M.) Spine.

From the Two Feet Mine of Bardsley. (W. 939, e. coll. Wild, M.M.) Spine.

From the Low Bottom Bed of Fulledge Colliery, Burnley. (W. 945, e. coll. Wild, M.M.) Spines.

From the Californian or Thin Bed at Fulledge Colliery, Burnley. (W. 950 and 948, e. coll. Wild, M.M.) Spines and teeth.

From the Arley Mine of Fulledge Colliery, Burnley. (L. 2166, e coll. Kay-Shuttleworth, M.M.) Spine.

From the Cannel seam of Wigan. (e. coll. Bowman, M.M.) Spine.

From Ashton Moss Colliery, Audenshaw. Horizon not stated. (L. 2398, e. coll. Cairns, M.M.) Teeth.

Sphenacanthus sp. indet.

From Ashton Moss Colliery, Audenshaw. Horizon not stated. (L. 2613, e. coll. Cairns, M.M.)

Dorsal Rays (*Sphenacanthus, H.B.*)

In shale over the Californian or Thin Bed of Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

(*Large Dorsal Ray*), *Sphenacanthus* (?) *H.B.*

In the Cannel Mines at Haigh. (Binney, Trans. Manch. Geol., Soc., Vol, I., p. 157.)

Ctenacanthus sp. (? *Sphenacanthus, H.B.*)

In shale over the Californian or Thin Bed at Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

Stemmatodus.

From Bastard Cannel at 647 yards. Diamond Shaft, Bardsley. (W. 1096, e. coll. Wild, M.M.)

From over the Royley (Arley) Mine at Nook Colliery, Broad Oak, Ashton-under-Lyne. (W. 1066, e. coll. Wild, M.M.)

From the Arley Mine of Burnley. (W. 1076, e. coll. Wild, M.M.)

Acanthodes Wardi (Egerton).

From the Middle Coal Measures of Middleton, Manchester. (M.M.)

From Ashton Moss Colliery, Audenshaw, Middle Coal Measures. (L. 2608, e. coll. Cairns, M.M.)

In neither of these cases can the horizon be determined.

From 360 yards deep at Ashton Moss Colliery, Audenshaw. (W. 956, e. coll. Wild, M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 1069, e. coll. Wild, M.M.) Associated with *Callopristodus pectinatus.*

Acanthodes sp. indet.

From 360 yards deep at Ashton Moss Colliery, Audenshaw, and also from the "Marine band" of the River Tame,

Dukinfield. I am uncertain now whether (W. 757, e. coll. Wild, M.M.) is from the former or the latter locality and horizon, and I am too far away to refer to the specimens.

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 954 and W. 1069, e. coll. Wild, M.M.) The latter specimen is associated with *Callopristodus pectinatus*. In black stone roof over seven inch inferior Coal, the latter at 646 yards deep, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 426.)

Hoplonchus elegans (Davis).

This beautiful little fish spine, much like that of Sphenacanthus hybodoides in miniature, has not hitherto, I believe, been recorded from Lancashire, but I was able to prove its occurrence in the Middle Coal Measures of Lancashire by direct comparison with plaster casts of the types, kindly sent to me whilst at Owens College, by Dr. A. Smith Woodward.

From the Arley Mine of Burnley. (W. 1104, e. coll. Wild, M.M.)

From Fulledge Colliery, Burnley. (L. 1699, e. coll. Kay-Shuttleworth, M.M.) Horizon not stated but probably the Arley Mine. The specimen is associated with a tooth of *Pleuroplax Rankinei*.

From over the Royley (Arley) Mine of Hurst, Ashton-under-Lyne. (W. 1093, e. coll. Wild, M.M.)

Lepracanthus Colei (Egerton).

From the Arley Mine of Burnley. (W. 1103, e. coll. Wild, M.M.)

From Towneley Colliery, Burnley. Horizon not stated. (W. 957, e. coll. Wild, M.M.)

Cladodus.

This generic term has been frequently applied to teeth of Sphenacanthus hybodoides, which see.

Gyracanthus formosus (Agassiz).

This species is remarkable in that it evidently possessed two forms of spines, one form robust and elongated, and probably borne in pairs on the front edge of the paired fins, the other laterally compressed and broadly triangular in outline. The latter are usually called "free spines." Free spines are rare in the Lancashire Coal Measures, I only know of the following :—

From the Stubbs Mine of Bardsley. (L. 2622, e. coll. Cairns, M.M.)

From the Middle Coal Measures of Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

Paired Spines.

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 968 and W. 972, e. coll. Wild, M.M.)

From the roof of the Arley Mine, Burnley. (W. 971, e. coll. Wild, M.M.) Associated with a quartzite pebble.

From the Two Feet Mine of Bardsley. (W. 937, e. coll. Wild, M.M.)

From Ashton Moss Colliery at 400-500 yards. No horizon stated. (L. 2612, e. coll. Cairns, M.M.)

From the Stubbs Mine of Bardsley. (W. 1218, e. coll. Wild, M.M.) Associated with Carbonicola.

In shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

Listracanthus sp. n.

From the "Marine Band," River Tame, Dukinfield. (e. coll. Cairns, M.M.)

Euctenius unilateralis (Barkas).

The curious structures known by this name are very rare in the English Coal Measures, and little is known respecting

them. They are regarded as dermal defences. A specimen from the Nield Mine of Glodwick, Oldham, is in the Wild collection (W. 801) of the Manchester Museum. It is the only known specimen from Lancashire, and is associated with remains of *Strepsodus sauroides*.

Ctenodus cristatus (Agassiz).

Three specimens from the Two Feet Mine of Bardsley. (W. 974, e. coll. Wild, M.M.)

Ctenodus sp. indet.

Scale from the Californian or Thin Bed of Burnley. (L. 2262, e. coll. Kay-Shuttleworth, M.M.) Dental plate from the same horizon and locality. L. 2314, M.M.)

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

In shale over the Two Feet Mine at 475 yards from surface, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 457.)

Sagenodus inæqualis (Owen).

From the Nield Mine of Glodwick, Oldham. (W. 977, e. coll. Wild, M.M.)

Megalichthys Hibberti (Agassiz).

From Fulledge Colliery, Burnley. No horizon stated. (e. coll. Kay-Shuttleworth, M.M.)

From 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (L. 2614, e. coll. Cairns, M.M.)

From the Cannel or Two Feet Mine of Dukinfield. (W. 849, e. coll. Wild, M.M.)

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 850 and W. 815, e. coll. Wild, M.M.)

From the Two Feet Mine of Bardsley. (W. 820 and W. 306, e. coll. Wild, M.M.) W. 306 is a micro-section of a scale.

From the Bastard Cannel of the Fulledge Colliery, Burnley. (W. 840, e. coll. Wild, M.M.)

From the Arley Mine of Fulledge Colliery, Burnley. (W. 846 and W. 855, e. coll. Wild, M.M.)

From the Cannel Seam of Wigan. (e. coll. Bowman, M.M.)

From the Seven Inch Bastard Cannel of Bardsley. (W. 858 and 859, e. coll. Wild, M.M.)

From below the Stubbs Mine of Bardsley. (W. 856 and 857, e. coll. Wild, M.M.)

From eight yards above the Old Mine, Bardsley. (W. 1078, e. coll. Wild, M.M.)

From Broad Oak Colliery, Ashton-under-Lyne. Horizon not stated. (L. 2944, M.M. Donor, Mr. Grundy.)

From the Cannel seam of Haigh, near Wigan. (e. coll. Bowman, M.M.)

From Peel Delph. Horizon not stated.

From Black Bass over the Four Feet Mine, Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

From above the Trencherbone Coal at Green, near Bolton. Section on the river Irwell. (Salter, Geol. Surv. Men., Geology of Country around Bolton-le-Moors, p. 41.)

From over the Great Mine at Ashton-under-Lyne. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

From the Cannel of Wigan. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Megalichthys intermedius (Woodward).

From Fulledge Colliery, Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

From Bradford, near Manchester. Horizon not stated. M.M.)

Megalichthys pygmæus (Traquair).

From Fulledge Colliery, Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

From below the Stubbs Mine of Bardsley. (W. 851, e. coll. Wild, M.M.)

From Middleton. Horizon not stated. (e. coll. Williamson, M.M.)

From the Cannel Coal of Wigan. (e. coll. Bowman, M.M.)

Megalichthys sp.

In shale over Two Feet Mine at 475 yards from surface, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 457).

Roof of half-inch coal at 18 yards over a 9 inch coal, the latter at 622 yards deep, Bardsley Colliery. (Op. cit., p. 461.)

Roof of nine-inch coal at 622 yards deep, Bardsley Colliery. (Op. cit.)

In blackstone roof over seven-inch inferior Coal, the latter at 646 yards deep, Bardsley Colliery. (Op. cit.)

In Bastard Cannel at 647 yards deep, Bardsley Colliery. (Op. cit.)

In roof of the Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (Op. cit.)

In shale over the Californian or Thin Bed at Fulledge Colliery, Burnley. (Op. cit.)

In shale over the Great Mine, Fulledge Colliery, Burnley. (Op. cit).

In the Cannel Mines at Haigh. (Binney, Trans. Manch. Geol. Soc., Vol. I., p. 157.)

As "Diplopterus" from 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (e. coll. Cairns, M.M.)

As "Diplopterus" from Bradford, Manchester. Horizon not stated. (e. coll. Williamson, M.M.)

As "Diplopterus" said to occur in the Cannel Mines at Haigh. (Binney, Trans. Manch. Geol. Soc., Vol. I., p. 157.)

As "Diplopterus" from the Cannel of Wigan. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

As "Diplopterus" from black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

Strepsodus sauroides (Binney).

From Bradford, near Manchester. Horizon not stated. (e. coll. Bowman, M.M.) Associated with minute cyprids.

From the Cannel seam of Wigan. (e. coll. Bowman, M.M.)

From 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (L. 2603, e. coll. Cairns, M.M.)

From the Californian or Thin Bed at Fulledge Colliery. (L. 2203, e. coll. Kay-Shuttleworth, M.M.) Associated with *Rhizodopsis sauroides.*

From below the Stubbs Mine at Bardsley. (W. 810, e. coll. Wild, M.M.)

From the Two Feet Mine at Bardsley. (W. 809, e. coll. Wild, M.M.) W. 873 e. coll. Wild, same locality and horizon, is associated with Ostracods.

From the Cannel Mine of Dukinfield. (W. 807, e. coll. Wild, M.M.)

From the Nield Mine of Glodwick, Oldham. (W. 802 and W. 801,* e. coll. Wild, M.M.)

From the Great Mine of Fulledge Colliery, Burnley. (W. 799, e. coll. Wild, M.M.)

From below the Two Feet Mine at Woodpark, Bardsley. (W. 798, e. coll. Wild, M.M.)

From the Fairbottom Mine of Bardsley. (W. 797, e. coll. Wild, M.M.)

From Ashton Moss Colliery, Audenshaw. Horizon not stated. (W. 794, e. coll. Wild, M.M.)

From Bastard Cannel at 647 yards, Burnley or Bardsley. (W. 806 e. coll. Wild, M.M.), a tooth labelled "Rhomboptychius."

* W 801 is associated with an impression of Euctenius unilateralis.

From about 60 yards above the Royley Mine at Sparth Bottoms, Rochdale. Specimen in the Rochdale Museum.

Strepsodus sulcidens (Hancock & Atthey).

From the Nield Mine of Glodwick, Oldham. (W. 793, e. coll. Wild, M.M.)

From the Middle Coal Measures of Lancashire. No horizon or locality. (e. coll. Williamson, M.M.)

From the Arley Mine of Fulledge Colliery, Burnley. (e. coll. Kay-Shuttleworth, M.M.)

Strepsodus sp. indet.

From shale below the Doe Mine, River Irwell, Clifton Hall. (e. coll. Dawkins, M.M.)

From Astley Pit, Dunkinfield. No horizon stated. (L. 2602, e. coll. Cairns, M.M.)

As "Holpoptychius" from the Cannel of Wigan. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Rhizodopsis sauroides (Williamson).

This species was usually described by older geologists as "Rhizodus," "Rhizodus granulatus" and "Holoptychius."

From 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (L. 2600, e. coll. Cairns, M.M.)

From the Arley Mine of Fulledge Colliery, Burnley. (L. 2387, e. coll. Kay-Shuttleworth, M.M.) Associated with Strepsodus sauroides. (W. 789, e. coll. Wild, M.M.)

From the Four Feet Mine of Pendleton. (M.M.)

From below the Stubbs Mine of Bardsley Colliery. (W. 791, e. coll. Wild, M.M.)

From the Nield Mine of Glodwick, Oldham. (W. 780, e. coll. Wild, M.M.)

From the Cannel Coal of Peel Delph, Bolton. (e. coll. Williamson, M.M.)

From the Californian or Thin Bed of Burnley. (L. 2203, e. coll. Kay-Shuttleworth.)

From 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (L. 2602, e. coll. Cairns, M.M.) Associated with an unknown and possibly new fish spine, the "Strepsodus" of George Wild, in Trans. Manch. Geol. Soc., Vol. XXII., p. 449.

From Bastard Cannel forming the floor of the Trencherbone seam at St. Cerges Pit, Tyldesley. This Cannel also contains *Carbonicola acuta* in its upper portion, viz., close against the bottom of the Trencherbone.

As "Holoptychius sauroides," from black bass, over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

As "Rhizodus granulatus," from the Three Yard Mine at Hulton Colliery, three miles S.W. of Bolton. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 41.)

As "Rhizodus granulatus," from Vitriol Works, two miles S.E. from Bolton. (Salter, op. cit., p. 41.)

As "Rhizodus granulatus," from Black Mine at Dukinfield Hall. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 64.)

Rhizodontoid vertebræ.

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (e. coll. Kay-Shuttleworth, M.M.)

From above the Royley Mine at Nook Colliery, Broad Oak, Ashton-under-Lyne. (W. 1061, e. coll. Wild, M.M.)

From the Pomfret Mine of Bardsley Colliery at 170 yards. (W. 1179, e. coll. Wild, M.M.)

From the Two Feet Mine of Bardsley Colliery. (W. 1180, e. coll. Wild, M.M.)

Ditto. (W. 1181, e. coll. Wild, M.M.*)

From 400-500 yards deep in shaft of Ashton Moss Colliery. (W. 1182, e. coll. Wild, M.M.)

* Associated with ribs of "Ctenodus," *i.e.*, Archegosaurus.

Rhizodus (*Rhizodopsis*) *sp.*

In Bastard Cannel at 647 yards deep. Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 463.)

In shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

In roof of Cannel Coal at 162 yards, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 184.)

In the Cannel Mine at Haigh. (Binney, Trans. Manch. Geol. Soc., Vol. I., p. 157.

As "Rhizodus" n. sp. from above King Coal at Whittle Green Colliery. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Cœlacanthus elegans (Newberry).

From below the New Mine at Dukinfield. (W. 864, e. coll. Wild, M.M.)

From 415 yards deep in shaft of Ashton Moss Colliery. (W. 867, e. coll. Wild, M.M.)

Also (L. 2589, e. coll. Cairns, M.M.) at 400-500 yards deep in shaft. (This latter specimen is No. 8 of Wild, in Trans. Manch. Geol. Soc., Vol. XXII., p. 448.)

From the Arley Mine of Burnley. (W. 862, e. coll. Wild, M.M.) and (L2421, e. coll. Kay-Shuttleworth, M.M.)

From the Four Feet Mine of Pendleton (e. coll. Bowman, M.M.) Associated with *Rhizodopsis sauroides*.

From the Cannel seam of Peel, Bolton. (e. coll. Bowman, M.M.)

From Bastard Cannel of New Copy Colliery, Clivger. (W. 870, e. coll. Wild, M.M.)

In the Wild collection of the Manchester Museum are two specimens (W. 866 and W. 865), one marked "Blendfire Mine of Glodwick, Oldham," the other the "Neild Mine of Glodwick, Oldham." As the specimens are counterparts, one horizon must be wrong.

As "Coelacanthus lepturus" from Wigan. No horizon stated. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Cœlacanthus sp.

From the "Marine band" of Ashton Moss Colliery, Audenshaw. (W. 755, e. coll. Wild, M.M.)

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

From the Cannel Coal (?) of Peel, Bolton. Originally labelled "Holoptychius."

In Shale over the Californian or Thin Bed, Fulledge Colliery, Burnley. (George Wild, Trans. Manch. Geol. Soc., Vol. IV., p. 185.)

Rhadinichthys Wardi (Traquair).

From 400–500 yards deep in shaft of Ashton Moss Colliery, Audenshaw. (L. 2587, e. coll. Cairns, M.M.) This specimen is No. 5 of Wild, Trans. Manch. Geol. Soc., Vol. XXII., p. 448.

From Collyhurst, Manchester. Horizon not stated. (L. 3186, e. coll. Salford Museum, M.M.)

Rhadinichthys Planti (Traquair).

This species is recorded from Collyhurst. Horizon not stated. The type specimen should be in the collections of the Salford Museum, but I failed to find it when re-

arranging the geological collections there. Specimens of this species are, however, there in the duplicate series.

Elonichthys Aitkeni (Traquair).

From the Arley Mine of Rowley Colliery. (e. coll. Kay-Shuttleworth, M.M.)

From the Arley Mine of Burnley. (W. 1013 and W. 1014, e. coll. Wild, M.M.)

Elonichthys striolatus (Agassiz).

From the Arley Mine of Burnley. (W. 1020, e. coll. Wild, M.M.)

Elonichthys (*olim Palæoniscus*) *Egertoni* (Agassiz).

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans., Manch. Geol. Soc., Vol. I.

Elonichthys sp. indet.

From the Californian or Thin Bed of Burnley. (e. coll. Kay-Shuttleworth, M.M.)

As "Palæoniscus sp." from between the Yard and Bone Coals at Freeman's Colliery. (Salter, Geol. Surv. Mem., Geology of Country around Wigan, p. 36.)

Acrolepis (*?*).

From the Middle Coal Measures of Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

Mesolepsis scalaris (Young).

From the Middle Coal Measures of Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

From the Arley Mine of Burnley. (W. 1012, e. coll. Wild, M.M.) This specimen is doubtfully referred by me to M. scalaris.

Cheirodus granulosus (Traquair).

From 400-500 yards deep in shaft at Ashton Moss Colliery, Audenshaw. (e. coll. Cairns, M.M.)

From the Middle Coal Measures of Higham Hill Park, Padiham. Horizon not stated. (L. 2326 and 2341 e. coll. Kay-Shuttleworth, M.M.)

A splenial or pterygoid element of the skull of this species is in the Wild Collection of the Manchester Museum. (W. 994, e. coll. Wild, M.M.), but with no horizon or locality. It is almost certainly Lancashire.

Platysomus parvulus (Agassiz).

From the Four Feet Mine of Pendleton Colliery. (M.M.)

From the Middle Coal Measures of Burnley. Horizon not stated. (e. coll. Kay-Shuttleworth, M.M.)

Platysomus (parvulus, H.B.)

From black bass over the Four Feet Mine at Pendleton. (Binney, Trans. Manch. Geol. Soc., Vol. I.)

Palæoniscus sp.

"Holoptychius." From bituminous schists of the Black and White Mine at Peel. (Williamson, Brit. Assoc. Report, Liverpool, quoted by Binney, Trans. Manch. Geol. Soc., Vol. I., p. 157.)

Roof of half inch coal at 18 yards over a 9 inch coal, the latter at 622 yards deep, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 461.)

Fish Remains (Gen. and spec. indet.).

Over coal 6 inches above the Water Mine, the latter at 517 yards from surface, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 458.)

Scarce in inferior Cannel called the Lower Cannel at 525 yards from surface, Bardsley Colliery. (George Wild, op. cit.)

In brown shale 5½ yards below the Lower Cannel, the latter at 525 yards from surface. (George Wild, op. cit.)

In black bassy shale 12 yards below the Lower Cannel, the latter at 525 yards from surface. (George Wild, op. cit.)

Above half-inch coal at 639 yards, Bardsley Colliery. (George Wild, op. cit.)

In hard black shale over one and a half-inch Bass Coal, the latter at a depth of 678 yards, Bardsley Colliery. (George Wild, op. cit.)

In a micaceous shale over Coaly Bass at 115 yards, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 446)

Shagreen.

In a micaceous shale over Coaly Bass at 115 yards, Bardsley Colliery. (George Wild, Trans. Manch. Geol. Soc., Vol. XVIII., p. 446.)

Coprolites.

From the Californian or Thin Bed of Fulledge Colliery, Burnley. (W. 1858, e. coll. Wild, M.M.)

From the Stubbs Mine of Bardsley. (W. 1857, e. coll. Wild, M.M.)

AMPHIBIA.

Archegosaurus (*?*).

Fragment of rib from the Californian or Thin Bed of Burnley. (W. 1221, e. coll. Wild, M.M.)

Amphibian remains from the Two Feet Mine of Bardsley. (W. 1220, e. coll. Wild, M.M. and L. 947, M.M.)

The remains consist of ribs, vertebræ and (?) shoulder girdle.

Impression of ribs and vertebræ from Bastard Cannel of Cliviger near Burnley. (W. 1159, e. coll. Wild, M.M.)

Having enumerated the fossil fauna of the Middle Coal Measures, and indicated the horizons and localities in which each species occurs, it is now necessary to consider the faunal development of each horizon, by which the range of each species can be determined, and the data made readily available to the needs of the practical miner and field geologist.

It will be noted that undetermined species of most genera are indicated in the range columns.

The need to record the genus, where the species is yet unknown, arises from the fact that frequently examples of the genus are recorded from an horizon from which no known species has yet been obtained. An example will make this clear. Sphenacanthus sp. is recorded from the Royley or Arley Mine of the Oldham, Barnsley, and Ashton-under-Lyne district, but no known species.

Sphenacanthus hybodoides does occur in the Two Feet and Pomfret Mines of Bardsley. Did we fail to record Sphenacanthus sp. from the Royley Mine, it would naturally be assumed that the genus was restricted to the two seams mentioned. In tabulating the range of species, it has been found necessary to divide the coalfield into districts, and deal with the faunal horizons of each separately. The districts are as follows:—Burnley, Bolton, Wigan, and Bardsley, Oldham and Ashton-under-Lyne.

BURNLEY DISTRICT.

Horizons.

	Bastard Cannel at 15–16 yds. Full Edge.	Lower Yard Bed.	Bastard Cannel.	Low Bottom Bed.	Cannel Bed at 162 yds.	Californian or Thin Bed.	Great Mine.	Arley Mine.	Unknown Horizons.
Modiola	..	..	..	×	×	..	..	..	..
Naiadites (olim Anthracoptera) triangularis ..	..	..	..	..	..	..	..	..	×
Chaenocardiola Footi	..	..	..	..	..	..	..	..	×
Carbonicola (olim Anthracosia) robusta	×	×	..	..	..	..	..	×	..
,, ,, acuta var ovalis	..	..	..	..	..	×	..	..	..
,, ,, subconstricta ..	..	..	..	..	..	×	..	..	..
,, ,, angulata	..	..	..	×	..	..	..	..	..
,, ,, sp.	..	..	..	×	..	..	×	..	..
Orthonota	×	..	..	×	..	..	..	..	..
Anthracomya Wardi	..	..	×	..	..	..	..	..	×
,, dolabrata	..	..	..	..	..	..	×	..	..
,, sp.	..	..	..	×	..	..	..	..	..

Beyrichia arcuata	..	..	..	×	..	..	..	..	..
Cyprina	..	..	..	×	..	..	..	..	..
Ostracods	..	..	×	..	..	..	..	..	..
Diplodus gibbosus	..	..	..	..	..	×	..	..	×
,, sp.	..	..	..	..	×	×	..	..	..
Pleuracanthus lævissimus	..	..	..	..	..	×	..	×	..
,, alatus	..	..	..	..	..	..	..	×	..
,, cylindricus	..	..	..	..	..	..	..	..	×
,, undulatus	..	..	..	..	..	×	..	..	..
,, serratus	..	..	..	..	..	..	..	..	×
,, denticulatus	..	..	..	..	..	×	..	..	..
,, sp.	..	..	..	..	..	×	..	..	..
Ctenoptychius apicalis	..	..	..	..	..	×	..	×	..
Callopristodus pectinatus	..	..	..	..	..	×	..	..	..
Helodus simplex	..	..	..	..	..	×	..	×	..
Pleuroplax (olim Pleurodus) Rankinei	..	..	..	..	..	×	..	×	..
,, ,, Attheyi	..	..	..	..	..	×	..	..	..
,, ,, sp.	..	..	..	..	..	×	×	×	..
Psephodus magnus	..	..	..	..	..	..	..	×	..
Sphenacanthus hybodoides	..	..	..	×	..	×	..	×	..

BURNLEY DISTRICT, HORIZONS.—*Continued.*

	Bastard Cannel at 15-16 yds. Full Edge.	Lower Yard Bed.	Bastard Cannel.	Low Bottom Bed.	Canal Bed at 62 yds.	California or Thin Bed.	Great Mine.	Arley Mine.	Unknown Horizons.
Stemmatodus	..	..	..	..	..	..	..	×	..
Acanthodes Wardi	..	..	..	..	..	×	..	..	..
,, sp.	..	..	..	..	..	×	..	..	..
Hoplonchus elegans	..	..	..	..	..	..	..	×	..
Lepracanthus Colei	..	..	..	..	..	..	..	×	×
Gryacanthus formosus	..	..	..	..	..	×	..	×	×
,, sp.	..	..	..	..	..	×	..	..	..
Megalichthys Hibberti	..	..	×	..	..	×	..	×	×
,, intermedius	..	..	..	..	..	..	..	..	×
,, pygmæus	..	..	..	..	..	..	..	..	×
,, sp.	..	..	..	..	×	×	×	..	..
Strepsodus sauroides	..	..	..	..	..	×	×	..	..
,, sulcidens	..	..	..	..	..	..	..	×	..

Rhizodopsis sauroides..	..	..	..	..	..	×	..	×	..
,, sp.	..	..	..	..	×	..	..	..	..
Rhizodontoid vertebræ	..	..	..	..	..	..	..	×	×
Coelacanthus elegans	..	..	×	..	..	..	..	×	..
Elonichthys Aitkeni	..	..	..	..	..	..	..	×	..
,, striolatus	..	..	..	..	..	..	..	×	..
,, sp.	..	..	..	..	..	×	..	..	..
Cheirodus granulosus	..	..	..	..	..	..	..	..	×
Platysomus parvulus	..	..	..	..	..	..	..	..	×
Coprolites	..	..	..	..	..	×	..	..	..
Archegosaurus	..	..	..	..	..	×	..	..	..

Burnley District.

The Middle Measures of the Burnley district have yielded, if we eliminate doubtful genera such as "Modiola" and "Orthonota," no less than 27 genera and 38 species belonging to the following groups:—Pelecypoda, four genera, eight species. Crustacea, one genus and one species. Pisces 20 genera and 29 species. Amphibia one genus.

The dominant forms are fishes, which come in at the very bottom of the Coal Measures, no less than 16 species occurring in the roof of the Arley Mine, and 15 in the roof of the Californian or Thin Bed. Cephalopoda and Brachiopoda appear to be absent, whilst Crustacea and Pelecypoda are less abundant in numbers as well as species than in the Lower Coal Measures.

Most of the genera and species of fossils in the Burnley district come from the black shale roofs over the lower seams, the Californian or Thin Bed being most prolific.

The Bastard Cannel at Fulledge Colliery, and the Lower Yard Bed show a remarkable falling off, only one species of mollusca (C. robusta) being recorded from both if we except the form named by the late George Wild as "Orthonota." Mollusca and Crustacea are characteristic of the Low Bottom Bed.

Bolton District.

An examination of the following table shows a marked difference to what we find in the Burnley area. There is a greater molluscan development, and a more general distribution of fossils through the whole Coal Measure series. Only in the case of the Pendleton or Worsley Four Feet Mine do we find a marked occurrence of fish remains, and these do not equal in genera and species what are found in the Burnley area.

BOLTON DISTRICT.

Horizons.

	Pendleton Four feet. Worsley Four Ft. Ellams Mine.	Ashclough or Bin Coal.	Brassey Mine.	Three Yard Mine of Bolton. Crumbourke & Brassey Mines.	Seven Feet, Rams Mine, or Big Coal.	Yard Mine.	White and Black Mines.	Ten feet Mine (White and Black Mines.)	Doe Coal.	Shale below Doe Coal.	Five Quarters Mine.	Trencherbone Mine.	Cannel forming floor of Trencherbone.	Cannel Mine.	20 yards above Arley Mine.	Horizon unknown.	"Mussel-bed," Pendleton.	Impure Cannel, Pendleton and Agecroft Collieries.
Spirorbis pusillus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
Naidites (olim Anthracoptera)–																		
Browniana	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	×
sp.	..	..	..	×	..	×	..	×	..	..	..	..	..	×	×	..	..	..
Schizodus sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
Carbonicola (olim Anthracosia)–																		
robusta	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..
acuta	..	..	..	×	..	..	..	..	×	..	..	..	×	×	×	×	..	..
,, var ovalis	..	×	×	×	×	..	..	..	..	..	..	×	..	×	..	..	..	..

BOLTON DISTRICT, Horrsons.—*Continued.*

	Pendleton Four Feet, Worsley Four Ft. Ellams Mine.	Ashclough or Bin Coal.	Brassey Mine.	Three Yard Mine of Bolton. Crumbouke & Brassey Mine.	Seven Feet, Rams Mine, or Big Coal.	Yard Mine.	White and Black Mines.	Ten Feet Mine (White and Black Mines.)	Doe Coal.	Slate below Doe Coal.	Five Quarries Mine.	Trencherbone Mine.	Cannel forming floor of Threncherbone.	Cannel Mine.	20 yards above Arley Mine.	Horizon unknown.	"Mussel-bed," Pendleton.	Impure Cannel, Pendleton and Agecroft Collieries.
Carbonicola (olim Anthracosia)–																		
aquilina	:	×	×	×	×	×	:	:	:	:	:	:	:	×	:	:	:	:
obtusa	:	:	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:
centralis	:	:	:	×	:	:	:	:	×	:	×	:	:	×	:	:	:	:
sp.	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:	:
Edmondia	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Anthracomya sp.	:	:	:	:	:	:	:	:	:	:	×	×	:	:	:	:	:	:
Beyrichia arcuata	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:	:
Estheria tenella	×	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Ostracods	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	×	:	:
Prestwichia rotundata	:	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:	:	:

Arthropleura (olim Eurypterus)-mammatus					×													
Euphoberia ferox					×													
,, Browni										×								
Diplodus gibbosus	×															×		
Pleuracanthus cylindricus																×		
Ctenoptychius apicalis	×																	
Callopristodus pectinatus	×															.		
Gyracanthus sp.	×																	
Ctenodus sp.	×																	
Megalichthys Hibberti												×						
,, sp.	×															×		
Strepsodus sp.										×								
Rhizodopsis sauroides				×									×			×		
,, sp.	×						×											
Coelacanthus sp.	×																	
Rhadinchthys sp.							×											
Elonichthys Egertoni	×																	
Platysomus parvulus	×																	

WIGAN DISTRICT.

Horizons.

	Wigan Nine Feet Mine.	Cannel Coal.	Above King Coal.	Between Bone and Yard Coals	Smith Coal (Orrel Five Feet).	47 yard above Orrell Four Feet (Arley Mine).	Above Orrell Four Feet (Arley Mine).	Horizon unknown.
Spirorbis carbonarius	..	..	..	×	..	..	..	..
Avicula tenua	..	..	..	..	..	..	×	..
Naiadites (olim Anthracoptera) Browniana	..	..	..	×	..	..	..	..
Tellinomya robusta	..	×	..	..	..	..	..	..
,, n. sp.	..	×	..	..	..	..	..	..
Carbonicola (olim Anthracosia) robusta	..	×	..	..	..	×	..	..
,, ,, acuta	..	..	..	..	×	..	..	..
,, ,, obtusa	..	..	..	..	..	..	..	×
,, ,, subconstricta	×	..	..	..	..	..	..	×
Anthracomya lævis var. scotica	..	×	..	..	..	..	..	..
Beyrichia Binneyana	..	..	..	..	..	..	..	×
Cytheropsis	..	..	..	..	..	..	..	×

Estheria striata	..	×	..	..	..	..	..	..
,, ,, var. Beinertiana	..	×	..	..	..	..	..	..
Diplodus gibbosus	..	×	..	..	..	..	..	..
,, sp.	..	..	..	..	..	..	..	×
Ctenoptychius sp.	..	×	..	..	..	..	..	..
Callopristodus pectinatus	..	..	..	..	..	..	..	×
Sphenacanthus hybodoides	..	×	..	..	..	..	..	..
Megalichthys Hibberti	..	×	..	..	..	..	..	..
,, pygmæus	..	×	..	..	..	..	..	..
Strepsodus sauroides	..	×	..	..	..	..	..	..
Rhizodopsis sauroides	..	×	..	..	..	..	..	×
,, sp.	..	..	×	..	..	..	..	..
Coelacanthus elegans	..	×	..	..	..	..	..	×
Elonichthys sp.	..	..	..	×	..	..	..	..

The writer cannot but feel that the record of fossils from the Wigan district is an unsatisfactory one, and that much remains to be done in this area in the way of collecting. From the well known Cannel seam, a fair series of fish remains have been derived, and as noted elsewhere it is remarkable for the widespread occurrence of Tellinomya robusta, which is peculiar to the roof shales of the Cannel seam.

BARDSLEY, OLDHAM, AND ASHTON-UNDER-LYNE.

Horizons.

	Great Mine, Ashton-under-Lyne.	Above Stubbs Mine.	Below Stubbs Mine.	Fairbottom Mine.	Foot Coal below Fairbottom Mine.	Nield Mine or Upper Chamber Mine.	Pomfrey or Lower Chamber Mine.	Blenfire Mine.	Marine Band.	Black Mine.	New Mine.*	Old Mine.†	Royley or Arley Mine.	Ashton Moss, 400-500 yds.
Spirorbis pusillus	..	..	..	..	×	..	..	..	×	..	..	..	..	..
Discina orbicularis	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Aviculopecten papyraceous	..	..	..	..	..	..	..	..	×	..	..	..	..	..
,, fibrillosus	..	..	..	..	..	..	..	..	×	..	..	..	..	..
,, Cairnsii	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Naiadites (olim Anthracoptera) modiolaris	..	×	..	..	..	..	..	..	..	..	..	..	..	..
,, (,,) quadrata	..	×	..	..	..	..	..	..	..	..	..	..	..	..
,, (,,) carinata	..	..	..	×	..	..	..	..	..	..	..	..	..	..
,, (,,) sp.	..	..	..	..	..	×	..	..	..	×	..	..	..	..

* "The New Mine lies 100 to 120 yards above the Royley or Arley Mine." Hull. Geol. Surv. Mem., Geology of the Country around Oldham, p. 26.

† "The Hurst Old Mine is of importance in the Ashton district. It is probably either the Neddy Mine or one of the thin seams below it." Hull. op. cit., p. 26.

Ctenodonta sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Nucula lævirostrum	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Carbonicola (olim Anthracosia) acuta	..	..	..	..	..	..	..	..	..	×	..	..	×	×
,, (,,) acuta var. ovalis	..	..	..	..	..	..	..	..	..	×	×	..	..	..
,, (,,) nucularis	..	×	..	..	..	..	..	..	..	..	..	..	..	..
,, (,,) aquilina	..	×	..	..	..	..	..	..	..	..	×	..	..	×
,, (,,) obtusa	..	..	..	..	..	..	..	..	..	×	..	..	..	..
,, (,,) subrotundata	..	..	..	..	..	×	..	..	..	..	..	..	..	..
,, (,,) turgida	..	×	..	..	..	..	..	..	..	×	..	..	..	..
,, (,,) sp.	..	..	..	×	..	×	..	..	..	×	×	..	..	..
Anthracomya modiolaris	..	×	..	×	..	..	..	..	..	×	..	..	..	..
,, dolabrata	..	×	..	..	..	..	..	..	..	×	..	..	..	..
,, sp.	..	×	..	..	..	..	..	..	..	.	..	..	..	..
Serpulites, wavy sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Orthoceras, thin sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Nautilus precox	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Goniatites sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Discites rotifer	..	..	..	..	..	..	..	..	×	..	..	..	..	..
,, sp.	..	..	..	..	..	..	.	..	×	..	..	..	..	..

BARDSLEY, OLDHAM, AND ASHTON-UNDER-LYNE, HORIZONS.—(*Continued.*)

	Great Mine, Ashton-under-Lyne.	Above Stubbs Mine.	Below Stubbs Mine.	Fairbottom Mine.	Foot Coal below Fairbottom Mine.	Nield Mine or Upper Chamber Mine.	Pomfrey or Lower Chamber Mine.	Blenfire Mine.	Marine Band.	Black Mine.	New Mine.	Old Mine.	Royley or Arley Mine.	Ashton Moss, 400-500 yds.
Discites sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..
Ostracods	..	..	..	..	×	..	..	..	..	..	..	..	..	..
Estheria sp.	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Cyclus Johnsoni	..	..	..	×	..	..	..	..	..	..	..	..	..	..
Prestwichia rotundata	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Bellinurus bellulus	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Eoscorpius sparthinsis	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Pygocephalus Cooperi	..	..	..	..	..	..	..	..	..	×	..	..	..	..
Xylobius sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Euphoberia	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Neuropterus insect	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Diplodus gibbosus	..	..	×	..	..	×	..	..	..	..	..	×	..	×

Diplodus tenuis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
,, sp.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Pleuracanthus lævissimus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,, erectus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,, denticulatus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,, sp.	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
Ctenoptychius apicalis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Callopristodus pectinatus	..	..	..	..	..	..	..	..	..	.	..	×	..	..	×
Pleuroplax (olim Pleurodus) Rankinei	..	..	..	..	×	..	..	..	..	..	..	..	..	..	×
,, (,,) Attheyi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Sphenacanthus hybodoides	..	.	..	..	..	..	×	..	..	..	..	..	..	..	..
,, sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×
Stemmatodus	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Acanthodes Wardi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
,, sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
Hoplonchus elegans	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
Gyracanthus formosus	..	×	..	..	..	..	..	..	..	..	..	..	..	..	×
,, sp.	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Listracanthus, n. sp.	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
Euctenuis unilateralis	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..

BARDSLEY, OLDHAM, AND ASHTON-UNDER-LYNE, HORIZONS.—(*Continued.*)

	Great Mine, Ashton-under-Lyne.	Above Stubbs Mine.	Below Stubbs Mine.	Fairbottom Mine.	Foot Coal below Fairbottom Mine.	Nield Mine or Upper Chamber Mine.	Pomfrey or Lower Chamber Mine.	Blenfire Mine.	Marine Band.	Black Mine.	New Mine.	Old Mine.	Royley or Arley Mine.	Ashton Moss, 400-500 yds.
Ctenodus cristatus	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sagenodus inæqualis	..	..	..	..	..	×	..	..	..	..	..	..	..	..
Megalichthys Hibberti	..	..	×	..	..	..	..	..	×	..	..	..	..	×
,, pygmæus	..	..	×	..	..	..	..	..	..	..	..	..	..	×
Strepsodus sauroides	..	..	×	×	..	×	..	..	..	..	..	..	×	×
,, sulcidens	..	.	..	..	..	×	..	..	..	..	..	..	..	..
Rhizodontoid vertebræ	..	..	..	..	..	..	×	..	..	..	..	..	×	×
Coelacanthus elegans	..	..	..	..	..	×	..	×	..	..	..	×	..	×
Rhadinichthys Wardi..	..	..	..	..	..	..	..	..	..	..	..	..	..	×
Coprolites..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
Archegosaurus	..	..	..	..	..	..	..	..	..	..	..	..	..	..

BARDSLEY, OLDHAM, AND ASHTON-UNDER-LYNE DISTRICT.

In this district the shales above and below the Stubbs Mine and the Black Mine have proved especially rich in mollusca, whilst the Two-Feet Mine of Bardsley is equally productive in fish remains. Fossils from over the other seams are scanty. The most striking feature is the "Marine Band," discovered by Professor Green during the course of the Geological Survey, and located by Professor Hull as over the Great Mine. The fossils obtained from these shales in the River Tame near the bend, west of Dunkirk Colliery, received special attention from the Survey Palæontologist, Mr. J. W. Salter, who described three new species, and indicated the existence of several more. At a later date, the same band was cut through in the Ashton Moss Colliery, and a fine series of specimens obtained from the colliery waste heap by Mr. Robert Cairns, who afterwards generously presented them to the Manchester Museum at Owens College.

Mr. Salter regarded the fauna of this horizon as comparable to that of the Lower Coal Measures of Shropshire, and as markedly different from the Lower Coal Measures of Lancashire. This can now hardly be said to be correct, as the observations of the writer have shown that the Marine Band has yielded several species of fossils characteristic of the Lancashire Lower Coal Measures. The most important example is that of a new species of Listracanthus, the only other known species of which occurs in the Lancashire Lower Coal Measure series. We believe that the fauna of the Marine Band most closely approximates to that of the Bullion and Mountain Four Feet Mines, and that the differences are those naturally due to a later development.

By the industry of Messrs. Cairns, Moss and Grundy, a fine series of specimens were obtained from the spoil heaps

of the Ashton Moss Pit, when sinking operations were proceeding between the 400 and 500 yard levels. These are tabulated in a special column, as it is impossible to fix their horizon with accuracy.

Range in Time.

Whilst in the case of the Lower Coal Measures, the mollusca were the dominant forms, both in numbers and species, the Middle series show an even more pronounced development of fishes.

The highest division of animal life represented is the amphibia. The late Mr. George Wild collected rib fragments and vertebræ, of a distinctly amphibian character, from the Thin Bed of Fulledge, the Bastard Cannel of Cliviger, and the Two Feet Mine of Bardsley.

Taking the coalfield as a whole, it may be said that fish remains are equally abundant from the Arley Mine to the Worsley and Pendleton four-feet mines.

This does not seem to be the case in the various districts.

In the Burnley district, fish remains are mainly confined to the lower seams and are very scanty above the Californian or Thin Bed.

Fish remains in the Oldham district are fairly generally distributed, no seam showing such a preponderance as is seen in the case of the Arley and Thin seams at Burnley.

In the Wigan and Bolton districts, fish remains are mainly restricted to the Cannel, and the Pendleton and Worsley four-feet mines.

Cephalopoda and Brachiopoda are entirely restricted to the Marine Band.

The Bolton and Oldham districts are alike in the occurrence of rare forms of Crustacea and Myriopoda.

Ostracods occur in the measures of each district.

The mollusca occur on the whole but sporadically until the higher seams are reached. This is noticeable in each district.

List of Fossils Found in the Lower and Middle Coal Measures.

The accompanying list includes all the genera and species from the Lower and Middle Coal Measures which are known to the writer.

It will be seen that the list comprises about 75 genera and 137 species. Of these 42 genera and 73 species occur in the Lower series, and 60 genera and 106 species in the Middle, whilst no less than 28 genera and 36 species are common to the two, or in other words, 28 genera and 36 species pass up from the Lower into the Middle Coal Measures. As stated elsewhere, the fish fauna dominate the Middle series, and inasmuch as this development is shown in the roof of the Arley Mine, the lowest seam and the base of the series, it follows that the latter constitutes, not only an account of its constant character over the whole coalfield, but also on account of its palæontological features, a good line of demarcation between the Lower and Middle Coal Measures. The question of where the Upper limit of the Middle Measures must be drawn cannot be dealt with until we are able to tabulate the fossils of the Upper Series.

At present, the Upper limit is recognised as the Worsley four-feet, but a tendency has been shown latterly by palæobotanists to split up the Upper series, putting the lower portion with the Middle Measures, and adding the upper portion to the Permian.

The writer hopes in a subsequent paper to consider the question more fully, and to also complete this Palæontological survey of the Lancashire Coal Measures. In conclusion, we would gladly record the help and courtesy received during the preparation of this paper from the Honorary Secretary of the Society, Mr. William Saint, both in the supply of volumes of the transactions and in other ways. Finally, a word must be said of the splendid services rendered to Geological Science by the late Mr. George Wild, who brought together the largest and best located collection of coal fossils ever collected.

Without the opportunity of working over that collection, this paper could not have been written, and the writer would also add his testimony to the singular unselfishness and kindly character Mr. Wild always displayed in rendering help or supplying information.

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
Vermes.		
Arenicola carbonaria, (*Binney*)	×	..
Spirorbis pusillus, (*Martin*)	×	×
Brachiopoda.		
Discina orbicularis, (*Bolton*)	×	×
Lingula mytiloides, (*Sow.*) or L. Credneri, (*Geinitz*)	×	..
Lingula sp.	..	×
Pelecypoda.		
Aviculopecten papyraceus, (*Sow.*)	×	×
,, fibrillosus, (*Salter*)	..	×
,, Cairnsii, (*Bolton*)	..	×
Posidoniella lævis, (*Brown*)	×	..
,, minor, (*Brown*)	×	..
,, subquadrata, (*Hind*)	×	..
,, lævigata	×	..
Avicula tenua, (*Brown*)	..	×
Modiola	..	×
Naiadites (olim Anthracoptera) modiolaris, (*Sow.*)	×	×
,, ,, quadrata, (*Sow.*)	×	×
,, ,, Browniana, (*Salter*)	..	×
,, ,, triangularis, (*Sow.*)	..	×
,, ,, carinata, (*Sow.*)	..	×
,, ,, elongata, (*Hind*)	..	×
,, ,, crassa, (*Fleming*)	×	..
Chænocardiola Footi.	..	×
Ctenodonta sp.	..	×
Tellinomya robusta, (*Bolton*)	..	×
,, n. sp.	..	×
Nucula lævirostrum, (*Portlock*)	..	×

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
Schizodus deltoideus	×	
,, sp.		×
Carbonicola (olim Anthracosia) robusta, (*Sow.*)	×	×
,, ,, acuta, (*Sow.*)	×	×
,, ,, ,, var. ovalis, (*Martin*)	×	×
,, ,, ,, ,, rhomboidalis, (*Hind*)	×	×
,, ,, rugosa, (*Brown*)	×	×
,, ,, nucularis, (*Hind*)	×	×
,, ,, aquilina, (*Sow.*)	×	×
,, ,, obtusa, (*Hind*)		×
,, ,, subconstricta, (*Sow.*)	×	×
,, ,, subrotunda, (*Brown*)		×
,, ,, turgida, (*Brown*)		×
,, ,, similis, (*Brown*)		×
,, ,, angulata, (*de Ryckholt*)		×
"Edmondia"		×
"Orthonota"		×
Solenomya primæva, (*Phillips*)	×	
Monotis obtusa, (*Brown*)	×	
Anthracomya Wardi, (*Salter*)	×	×
,, modiolaris, (*Sow.*)		×
,, dolabrata, (*Sow.*)		×
,, minima, (*Ludwig*)		×
,, ,, var. carinata, (*Hind*)		×
,, lævis var. Scotica, (*Dawson*)		×
GASTEROPODA.		
Serpulites, wavy sp.		×
Turitella sp.		×
Raphistoma (?) ornata, (*Bolton*)	×	
Naticopsis globularis, (*Bolton*)		×

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
CEPHALOPODA.		
Discites rotifer, (*Salter*)	..	×
,, sp.	..	×
,, sp.	..	×
Nautilus precox, (*Salter*)	..	×
Ephippoceras costatum, (*Foord*)	×	..
,, clitellarium, (*Sow.*)	×	..
Coelonautilus subsulcatus, (*Phillips*)	×	..
,, quadratus, (*Fleming*)	×	..
Pleuronautilus falcatus, (*Sow.*)	×	..
Temnocheilus concavus, (*Sow.*)	×	..
,, carbonarius, (*Foord*)	×	..
Orthoceras teres, (*Sow.*)	×	..
,, cintum, (*de Koninck*) = O. discrepans, (*de Koninck*)	×	..
,, obtusum, (*Brown*)	×	..
,, sp.	×	×
Glyphioceras (olim Goniatites) sp. near truncatum	×	..
,, ,, reticulatum, (*Phillips*)	×	..
,, ,, diadema, (*Beyrich*)	×	..
,, ,, paucilobum, (*Phillips*)	×	..
Dimorphoceras Gilbertsoni, (*Phillips*)	×	..
Gastrioceras (olim Goniatites) carbonarium, (*Von Buch*)	×	..
,, ,, Listeri, (*Martin*)	×	..
,, ,, coronatum, (*Foord & Crick*)	×	..
Goniatites sp.	×	×
CRUSTACEA.		
Beyrichia arcuata, (*Bean*)	×	×
,, Binneyana, (*Jones*)	..	×
Cytheropsis	×	×
Cypris (?)	×	×

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
Estheria striata, (*Munst.*)	×	×
,, ,, var. Beinertiana, (*Jones*)	×	..
Belinurus bellulus, (*Konig*) (olim Limulus trilobitoides)	..	×
Prestwichia rotundata, (*Prestwich*)	×	×
,, Birtwelli, (*Woodward*)	×	..
Architarbus subovalis, (*Woodward*)	×	..
Cyclus Johnsoni	..	×
,, Scotti, (*Woodward*)	×	..
Arthropleura (olim Eurypterus) mammatus, (*Salter*)	..	×
Pygocephalus Cooperi, (*Huxley*)	×	×
Anthrapalæmon Etheridgii, (*Peach*)	×	..
Arachnida.		
Eoscorpius Sparthensis, (*Baldwin*)	..	×
Myriopoda.		
Euphoberia Brownii, (*Woodward*)	..	×
,, ferox, (*Salter*)	..	×
Xylobius sp.	..	×
Insecta.		
Neuropteris insect	..	×
Etoblattina (?)	..	×
Pisces.		
Diplodus gibbosus, (*Binney*)	..	×
,, tenuis, (*A. S. Woodward*)	..	×
Pleuracanthus lævissimus, (*Agassiz*)	..	×
,, alatus, (*Davis*)	..	×
,, cylindricus, (*Davis*)	..	×
,, undulatus, (*Davis*)	..	×

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
Pleuracanthus erectus, (*Davis*)	..	×
,, serratus, (*Davis*)	..	×
,, denticulatus, (*Davis*)	..	×
Ctenoptychius apicalis, (*Agassiz*)	..	×
Callopristodus pectinatus, (*Agassiz*)	..	×
Helodus simplex, (*Agassiz*)	..	×
Pleuroplax (olim Pleurodus) Rankinei, (*Hancock & Atthey*)	..	×
,, ,, Attheyi, (*Barkas*)	..	×
Psephodus magnus, (*McCoy*)	..	×
Hybodopsis Wardi, (*Barkas*)	×	..
Sphenacanthus hybodoides, (*Egerton*)	×	×
Stemmatodus	..	×
Acanthodes Wardi, (*Egerton*)	×	×
Hoplonchus elegans, (*Davis*)	..	×
Lepracanthus Colei, (*Egerton*)	×	×
Gyracanthus formosus, (*Agassiz*)	×	×
Listracanthus spinatus, (*Bolton*)	×	..
,, n. sp.	..	×
Euctenius unilateralis, (*Barkas*)	..	×
Ctenodus cristatus, (*Agassiz*)	..	×
Sagenodus inæqualis, (*Owen*)	..	×
Megalichthys Hibberti, (*Agassiz*)	×	×
,, intermedius, (*A. S. Woodward*)	..	×
,, pygmæus, (*Traquair*)	×	×
Strepsodus sauroides, (*Binney*)	×	×
,, sulcidens, (*Hancock & Atthey*)	..	×
Rhizodopsis sauroides, (*Williamson*)	×	×
Coelacanthus elegans, (*Newberry*)	×	×
Rhadinichthys Wardi, (*Traquair*)	..	×
,, Planti, (*Traquair*)	×	×

Fossils of the Lower and Middle Coal Measures.	Lower Coal Measures.	Middle Coal Measures.
Rhadinichthys monensis	×	..
Elonichthys Aitkeni, (*Traquair*)	×	×
,, Egertoni, (*Agassiz*)	×	×
,, striolatus, (*Agassiz*)	..	×
,, semistriatus, (*Traquair*)	×	..
Acrolepis (?)	..	×
Mesolepis scalaris, (*Young*)	..	×
Cheirodus granulosus, (*Traquair*)	..	×
Platysomus parvulus, (*Agassiz*)	..	×
Coprolites	×	×
AMPHIBIA.		
Archegosaurus	..	×

Mr. HARRISON, in moving a vote of thanks to Mr. Bolton, spoke of the Society's obligation to him for the immense pains he had taken in compiling so large and so valuable a record.

Mr. SAINT, who seconded the motion, said the thanks of the Society were specially due to Mr. Bolton for his valuable work. A further instalment dealing with the fossils of the Upper Coal Measures would be read shortly, and when Mr. Bolton had completed his work the Society would have in its Transactions an account of the fauna of the Lancashire coal measures such as no other Society in England possessed in relation to any other coalfield.

The motion was passed with acclamation.

PART III.

THE PALÆONTOLOGY OF THE LANCASHIRE COAL MEASURES.

By Mr. H. Bolton, F.R.S.E., The Museum, Bristol.

PART III.

The Upper Coal Measures.

The Upper Coal Measures of Lancashire occupy a limited surface area, to the south of the richer middle series. They occur in small patches in the Wigan area, and in the neighbourhood of Leigh, Worsley and Pendleton on the west of Manchester. The main development is, however, on the east and north of Manchester itself. The basement strata of the series in the Ardwick district contain several seams of coal which were worked over thirty years ago. It is to these productive measures of the upper series that the term "Manchester Coalfield" has been applied.

The uppermost beds of the series were very little known until the construction of the railway line from Fallowfield to Levenshulme and Longsight.

Prior to this, our knowledge of the upper beds was mainly limited to the published papers by Binney and others upon the Collyhurst section, which was opened in 1861 when the British Association visited Manchester.

The sections exposed in the railway cutting from Fallowfield to Levenshulme were worked over in the greatest detail

by Mr. Charles Roeder, and also by Messrs. Brockbank and De Rance.*

To Mr. Roeder we are especially indebted for our knowledge of the fauna of these beds.

With unwearied labour he examined and measured the section inch by inch, washing the clays and marls, and breaking up the thin limestones which occur all through the section. The collection of fossils thus obtained was forwarded by Mr. Roeder to Messrs. Jones and Kirkby, and others for identification, and the complete list was afterwards published in the Society's Transactions.

Mr. Roeder's collections were afterwards presented by him to the Manchester Museum, Owens College, where I had the opportunity and pleasure of working over them.

The fauna of the lower productive measures at Ardwick is chiefly known to us from the labours of Mr. Binney, who published his results in the Transactions of the Society, notably in Vol. VI.

Mr. Binney's work suffers from the free use of generalised statements and the absence of specific determination of the fossils.

The character of the Upper Coal Measure deposits differs in the upper portion very markedly from the rest of the whole Coal Measure series.

The succession of sandstones, shales and coals which we regard as the dominant feature of the Coal Measures is

*"Notes on the Upper Coal Measures at Slade Lane, Longsight," by Charles Roeder. Trans. Manch. Geol. Soc., Vol. XXI., p. 114.

"Further Notes on the Upper Coal Measures at Slade Lane, Burnage," by Charles Roeder. Op. cit. p. 199.

"Notes on the Geological section exposed in the Railway Cutting from Levenshulme to Fallowfield," Part I., by William Brockbank and C. E. de Rance, Mem. Proc. Lit. & Phil. Soc., Manchester, Vol. IV., Ser. IV., 1890-91.

Ditto. Part II. Op. cit.

"On the Entomostraca and Annelida in the Levenshulme Mottled Limestones." William Brockbank, op. cit.

replaced by a succession of thin limestones, calcareous clays and shales, and red and green sandstones.

No trace of a coal seam is seen amongst these beds.

Naturally so great a lithological change is accompanied by some change in the character of the fauna.

The change is not, however, of the nature of a replacement, it is rather one of extinction. Very many of the typical examples of the Coal Measure fauna disappear and with the exception of the Ostracoda, and Anthracomya, those which do persist are few in number and difficult to find.

As the uppermost beds of the Upper Coal Measures are destitute of coal seams, only feeble traces of a coal flora are present, and we must therefore rely on the fauna to determine whether these upper beds are most closely related to the Permians above or the productive Coal Measures beneath.

Notwithstanding the sudden change in lithological character, a change which undoubtedly foreshadows the deposits of the overlying Permian, there is, nevertheless, so far as the writer knows, only the slightest approximation in the fauna of the one to that of the other. The fauna of the overlying Permians has been worked out with great thoroughness by Mr. C. Roeder, and the late Prof. Geinitz, and is published in the Society's Transactions, Vol. XX. p. 537.

The fauna of the Permians, at Newton, described and figured by Captain Brown in the first volume of the Society's Transactions shows also the same marked divergence. The fossils of the Upper Coal Measures, sparse though they be, belong undoubtedly to a Coal Measure fauna, and the only striking disparity between them and those of the Middle and Lower series is to be found in the abundance of the ostracods in the former.

Even this disparity is not so great as it appears, for ostracods are abundant over not a few of the thick coals of the Middle series. By reason of their small size they have not

attracted the attention they deserve, and we are quite sure that further study in this direction will result in bringing the Middle Coal Measures more nearly into line with the Upper series.

The fauna of the Upper Coal Measures so far as we have been able to trace it, includes the following genera and species.

VERMES.

Spirorbis pusillus.

In beds Nos. 5, 12, 25a, 26 and 28 U.C.M. at Slade Lane, Longsight. (L. 1006, L. 996, and L. 1021, e. coll. Roeder, M.M.)

From U.C.M. at Ardwick, Manchester (M.M.).

As "Spirorbis carbonarius" recorded by Binney from all the limestones in the Upper Coal Measures of Ardwick, Manchester. (Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

See also Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 66.

As "Spirorbis carbonarius" recorded by Salter from thin red and black shales, and calcareous layers at Patricroft. (Salter. Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 44.)

Over the Bradford four-feet seam, in a bed of limestone one foot thick, 18 yards above the coal, and amongst plants and Anthracomya near to the seam. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560.)

Spirorbis helicteres.

In beds Nos. 5 and 28, U.C.M. at Slade Lane, Longsight. (L. 992, e coll. Roeder, M.M.)

Spirorbis sp.

In beds Nos. 6, 26 and 28, U.C.M. at Slade Lane, Longsight. (L. 1012 and L. 1019, e coll. Roeder, M.M.)

BRACHIOPODA.

None.

PELECYPODA.

Naiadites (olim Anthracoptera) Browniana.

In limestones, shales and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

From Ardwick, Bradford, &c. (Salter. Geol. Surv. Mem.., Geology of Country around Oldham, p. 67.)

Anthracomya minima var carinata.

From the Upper Coal Measures of Ardwick, Manchester.

Anthracomya Phillipsii.

In red and black shales and calcareous layers at Patricroft. (Salter, Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 44.)

In limestones, shales and blackband ironstones in the Upper Coal Measures at Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

The blackband ironstone is found with the highest bed of coal at Ardwick, vide Binney. It also contains numerous bones, scales, teeth and rays of fishes.

The type specimen was obtained from the Spirorbis limestone shales of Pendlebury. (Dr. Hind, Pal. Soc., Monog. on Carbonicola, &c., pt. II., p. 121.)

A specimen from the Upper Coal Measures of Ardwick, Manchester, is figured by Dr. Hind, op. cit., 1895, pl. XVI., fig. 10.

See also Etheridge, Geol. Mag. (2), IV. pl. XII., figs. 6 and 7.

It is recorded from over the Yard Mine of Bradford, Manchester, by Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.

From over the thick limestone of the Upper Coal Measures at Clayton. (Salter, op. cit., p. 67.)

From above the Bradford four-feet coal. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560).

Anthracomya lævis var Scotica.

From the Spirorbis limestone of Ardwick, Manchester. (Dr. Hind, Pal. Soc., Monog. on Carbonicola, &c., pt. 11., p. 124.)

Anatina-like shell.

From the thick limestone of the Upper Coal Measures at Clayton. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.)

Gervillæ and Arcae.

From beds Nos. 28 and 30 in bluish-purple and chocolate-purple calcareous clays at Slade Lane, Longsight. (Roeder, Trans. Manch. Geol. Soc., Vol. XXI., p. 114.)

GASTEROPODA.

None.

CEPHALOPODA.

None.

ARTHROPODA.

Estheria tenella.

In shales above four-feet coal at Bradford, near Manchester. (Salter, quoted by Rupert Jones, Pal. Soc., Monog. Fossil Estheriæ, p. 32.)

From fine grained red argillaceous sandstone in Mr. Jackson's pit at Astley, from 50 yards above the four-foot coal of Worsley and Pendleton. (Rupert Jones, op. cit., p. 32.) Salter also records this species from an ironstone associated with the four-foot coal.

Estheria sp.

From over the Yard Mine at Bradford, Manchester, (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 66.)

Leaia Leidyi var Williamsoniana.

In limestones, shales and blackband ironstone of U. C. M., at Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

From Ardwick limestone, U. C. M., Ardwick, Manchester. (c. coll. Williamson, M.M.)

See also Phil. Mag., New Series, Vol. IX., 1836, for description of horizon; and Rupert Jones, Pal. Soc. Monog., on Fossil Estheriæ, p. 116.

OSTRACODA.

Leperditia inflata.

In limestones, shales, and blackband ironstone in U.C.M. at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

From the Upper Coal Measures of Ardwick, Manchester. (Salter. Geol. Surv. Mem., Geology of Country around Oldham, p. 66.)

From above the Bradford four-feet coal. (Gerrard.)

Cythere or Leperdita.

From over the Yard Mine at Bradford, Manchester. (Salter. Geol. Surv. Mem., Geology of Country around Oldham, p. 66.)

Carbonia Roederiana.

Found in Upper Coal Measures at Slade Lane, Longsight. (Roeder. Trans. Manch. Geol. Soc., Vol. XXI., p. 137.)

Carbonia Salteriana (? Candona Salteriana.)

Occurring in association with Carbonia pungens in No. 10 bed, U.C.M. at Slade Lane, Longsight. (Roeder, op. cit., p. 137)

Carbonia pungens.

Occurring in association with Carbonia Salteriana in No. 10 bed, U.C.M. at Slade Lane, Longsight. (L. 975, e coll. Roeder, M.M.) See also Roeder, op. cit., p. 137.

Carbonia secans.

Occurring in the Upper Coal Measures at Slade Lane, Longsight. (Roeder, op. cit., p. 137.)

Carbonia fabulina.

Occurring in association with Carbonia bairdioides in No. 5 bed, U.C.M. at Slade Lane, Longsight. (L. 1001, e. coll. Roeder, M.M.) See also Trans. Manch. Geol. Soc., Vol. XXI., p. 137.)

Carbonia Bairdioides.

Occurring in association with Carbonia fabulina in No. 5 bed, U.C.M. at Slade Lane, Longsight. (L. 1001, e coll. Roeder, M.M.) Op. cit., p. 137.

Carbonia Rankiniana.

Known to occur, but no record.

Candona (?) Salteriana.

Occurring in the shales of the four-foot coal at Bradford Pit, near Manchester. (Rupert Jones. Pal. Soc. Monog. Fossil Estheriæ, p. 123.) From Upper Coal Measures at Slade Lane, Longsight. (Roeder. Trans. Manch. Geol. Soc., Vol. XXI., p. 137.)

Bairdia mucronata.

Known to occur, but no record.

ORTHOPTERA.

"*Orthopterus insect remains*" (*?.*)

Found amongst plant remains in a bed of purple shale lying about 60 feet above the main limestone. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

See also Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 66. The specimen was in Mr. Binney's cabinet.

PISCES.

Diplodus gibbosus.

In limestones, shales, and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

As "Pleuracanthus gibbosus" recorded from over the Yard Mine of the Upper Coal Measures at Manchester by Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 17.

From Ardwick, Manchester. (Salter, op. cit., p. 67.)

From bed No. 25, in the Upper Coal Measures at Slade Lane, Longsight. (L. 1617, e coll. Roeder, M.M.)

Pleuracanthus sp.

In limestones, shales, and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Oracanthus Milleri.

From the Upper Coal Measures of Ardwick, Manchester. (M.M.)

Oracanthus sp.

In limestones, shales, and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Ctenacanthus sp. (*? Sphenacanthus*).

In limestones, shales and blackband ironstone in the Upper Coal Measures of Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Gyracanthus formosus.

From the Upper Coal Measures of Ardwick, Manchester.

Gyracanthus sp.

In limestones, shales and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

From Upper Coal Measures of Manchester. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.)

Ctenodus Murchisoni

From the Upper Coal Measures of Ardwick, Manchester. Specimens in the Manchester Museum.

Ctenodus sp.

In limestones, shales and blackband ironstone of the Upper Coal Measures at Ardwick. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

"*Ceratodus sp.*" (*? Ctenodus*).

In limestones, shales and blackband ironstone of Upper Coal Measures of Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Megalichthys Hibberti.

From the Upper Coal Measures of Ardwick, Manchester. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.)

Megalichthys intermedius.

From the Upper Coal Measures of Ardwick, Manchester. (e. coll. Williamson, M.M.)

Megalichthys rugosus.

Above the Bradford four-feet coal. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560.)

Megalichthys sp.

In limestones, shales and blackband ironstone of the Upper Coal Measures of Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

As "Rhizodus sp." from the thick limestone of the Upper Coal Measures of Ardwick, Manchester. (Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.)

From the Upper Coal Measures of Ardwick, Manchester, (Salter, op. cit.)

Megalichthys (?)

As "Rhizodus n. sp." In thin red and black shales and calcareous clays at Patricroft. (Salter. Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 44.)

Rhizodopsis sauroides.

In association with Elonichthys from bed No. 12 of the Upper Coal Measures at Slade Lane, Longsight. (L. 1005, e coll. Roeder, M.M.)

Also from bed No. 12a. Same locality. (L. 1010, e. coll. Roeder, M.M.)

Above the Bradford four-feet coal. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560.)

Also from bed No. 25a. Same locality.

As "Rhizodus granulatus" from over the Yard Mine of Bradford, Manchester. (Salter. Geol. Surv. Mem., Geol. of Country around Oldham, p. 67.)

Rhizodopsis sp.

In limestones, shales, and blackband ironstone of the Upper Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Coelacanthus sp.

In limestones, shales, and blackband ironstone of the Upper Coal Measures of Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

Above the Bradford four-feet coal. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560.)

Elonichthys Aitkeni.

From above the Bradford four-feet coal. (Gerrard, Trans. Manch. Geol. and Min. Soc., Vol. XXVIII., p. 560.)

Elonichthys Egertoni.

As "Palæoniscus Egertoni" recorded from Upper Coal Measures of Ardwick, Manchester. (Salter. Geol. Surv. Mem., Geology of Country around Oldham, p. 67.)

Elonichthys sp.

In association with teeth of Rhizodopsis, from bed No. 12 of the Upper Coal Measures at Slade Lane, Longsight. (L. 1005, e. coll. Roeder, M.M.)

As "Palæoniscus" recorded by Binney as occurring in shales, limestones, and blackband ironstone of the Upper

Coal Measures at Ardwick, Manchester. (Binney. Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

As "Palæoniscus" from over the thick limestone of the Upper Coal Measures at Clayton. (Salter. Geol. Surv. Mem., Geol. of Country around Oldham, p. 67.)

"Palæoniscus scales" (Elonichthys) are also recorded from thin red and black shales and calcareous layers at Patricroft. (Salter. Geol. Surv. Mem., Geology of Country around Bolton-le-Moors, p. 44.

Amblypterus (? Elonichthys.)

From over the thick limestone of the Upper Coal Measures at Clayton. (Salter. Geol. Surv. Mem., Geol. of Country around Oldham, p. 67.)

Platysomus sp.

In limestones, shales and blackband ironstone of the Upper Coal Measures of Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.)

See also Salter, Geol. Surv. Mem., Geology of Country around Oldham, p. 67.

Coprolites.

From the Upper Coal Measures of Ardwick, Manchester. (M.M.)

AMPHIBIA.

Labyrinthodon sp.

Recorded by Mr. Charles Roeder, from bed No. 24A, of the Upper Coal Measures of Slade Lane, Longsight. (L. 1009. e. coll. Roeder M.M.)

NOTE.—The specimen is accompanied by a note of Mr. Roeder's, in which he says that according to Dr. A. Smith Woodward, similar equally ossified slender phalanges have been found in the Coal Measures of Kilkenny.

Amphibian remains.

In limestones, shales and blackband ironstone of the Upper Coal Measures of Ardwick, Manchester. (Binney, Trans. Manch. Geol. Soc., Vol. VI., p. 42.

Range of Fossils.

The task of arranging the fossils of the Upper Coal Measures according to the beds in which they occur has already been done in a large measure in the papers by Mr. Charles Roeder and the writings of Mr. Binney.

For the purposes of the present paper, the work of these authors will serve, although in another paper which we hope to publish at some later date on the zones and faunal development of the Lancashire Coal Measures, it will be necessary to subject to a careful review, the range of dominant genera and species, both geographically and in point of time.

One feature which will at once strike the student of the Upper Coal Measures is that the fauna is by no means so scanty as once supposed. Another feature of primary importance is that the fauna is throughout an essentially Coal Measure one. If we except the reference by Mr. Roeder to the occurrence of Arcæ and Gervillæ in beds Nos. 28 and 30 at Slade Lane, Longsight, there is absolutely nothing of a Permian character in the fauna.

The Upper Coal Measure fauna is apparently an impoverished replica of that of the Middle series.

It is not our intention to deal at length with the question of subdivision of the Upper Coal Measures on the lines recently laid down by palæobotanists. This can well be left

until the whole fauna is considered in its horizon and zonal aspects. One point, however, may be suggested as worthy of consideration before subdivision is attempted and this is, the question whether the flora or the fauna ought to be taken as the true index to the sequence of Coal Measure development. We are inclined to think that the fauna will furnish the most satisfactory and rational standard for several reasons. Chief of these is the fact that the faunal development is closely connected with and cannot readily be separated from the sequence of deposition. The vast bulk of deposits in the Coal Measures are of marine, lagunal or estuarine origin, the coal seams representing interludes of varying length in point of time, but being in themselves neither regular or naturally successively progressive. The fauna would we know, rapidly respond to changes of conditions, or of deposition, flourishing when conditions were favourable and migrating or being starved and attenuated when the conditions were unfavourable. In either case, the continuity of life and development would not be easily destroyed, and we should be more likely to find in the case of the fauna, and the deposits in which they occur, a well ordered continuity and developmental sequence, than in the case of the coal forests, which were intermittent in character, more inert to outside influences, and more dominated by local and special conditions.

That there was every likelihood of a progressive botanical development is very likely, but the relation of the coal plants as a whole to the Coal Measure series of deposits seems to us a minor one as contrasted to that of the fauna which was at once more sustained, more widespread and altogether more readily responsive to change.

If we briefly pass in review the fauna of the Upper Coal Measures we shall note how fully, as we have previously

mentioned, it is associated with that of the Middle series.

The division Vermes is represented by one species which has come up from the Middle Coal Measures and by one species which is new.

Brachiopoda, Gasteropoda and Cephalopoda are not represented at all. In the case of the first two they are weak throughout the Coal Measures, and the Cephalopoda owe their inclusion in the Middle series entirely to their occurrence in the local and well-known "Marine Band" at Dunkinfield.

The Pelecypoda of the Middle series mainly belong to the three genera Naiadites, Carbonicola and Anthracomya, and two of these genera are represented in the Upper Coal Measures.

The Ostracoda and their allies which are so constant a feature of the uppermost beds of shale and limestone at Slade Lane, Longsight, are closely connected with the genera of Ostracods found in the Middle series, and they also occur in these beds in association with Spirorbis pusillus which is as typical of the Middle series.

Fishes which were pre-eminent during the period of the Middle Coal Measures, are represented by nine genera and ten species, seven of the latter being most typical Middle Measure forms. Most of these fish remains range on the authority of Salter and Binney into the shales and limestones which lie above the coal seams in the Upper series.

As an appendix to this paper, we have added a list of all the authentic fossils we know of found in the Lancashire Coal Measures.

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Vermes.			
Serpulites wavy sp.	..	×	..
Spirorbis pusillus (*Martin*)	×	×	×
,, helicteres (*Salter*)	..	..	×
,, sp.	..	..	×
Arenicola carbonaria (*Binney*)	×	..	..
Brachiopoda.			
Lingula mytiloides (*Sow.*) or L. Credneri (*Geinitz*)	×	..	..
,, sp.	..	×	..
Discina orbicularis (*Bolton*)	×	×	..
Pelecypoda.			
"Orthonota"	..	×	..
Solenomya primæva (*Phillips*)	×	..	..
"Edmondia"	..	×	..
Tellinomya robusta (*Bolton*)	..	×	..
,, n. sp.	..	×	..
Nucula lævirostrum (*Portlock*)	..	×	..
Avicula tenua (*Brown*)	..	×	..
Monotis obtusa (*Brown*)	×	..	..
Posidoniella lævis (*Brown*)	×	..	..
,, minor (*Brown*)	×	..	..
,, subquadrata (*Hind*)	×	..	..
,, lævigata	×	..	..
Naiadites (olim Anthracoptera) modiolaris (*Sow.*)	×	×	..
,, ,, quadrata (*Sow.*)	×	×	..
,, ,, Browniana (*Salter*)	..	×	×
,, ,, triangularis (*Sow.*)	..	×	..
,, ,, carinata (*Sow.*)	..	×	..
,, ,, elongata (*Hind*)	..	×	..
,, ,, crassa (*Fleming*)	..	×	..
Carbonicola (olim Anthracosia) robusta (*Sow.*)	×	×	..
,, ,, acuta (*Sow.*)	×	×	..

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Carbonicola (olim Anthracosia) acuta var ovalis (*Martin*)	×	×	..
,, ,, acuta var rhomboidalis (*Hind*)	×	×	..
,, ,, rugosa (*Brown*)	×	×	..
,, ,, nucularis (*Hind*)	×	×	..
,, ,, aquillina (*Sow.*)	×	×	..
,, ,, obtusa (*Hind*)	..	×	..
,, ,, subconstricta (*Sow.*)	×	×	..
,, ,, subrotunda (*Brown*)	..	×	..
,, ,, similis (*Brown*)	..	×	..
,, ,, angulata (*de Ryckholt*)	..	×	..
Anthracomya Wardi (*Salter*)	×	×	..
,, modiolaris (*Sow.*)	..	×	..
,, dolabrata (*Sow.*)	..	×	..
,, minima (*Ludwig*)	..	×	..
,, ,, var carinata (*Hind*)	..	×	×
,, lævis var Scotica (*Dawson*)	..	×	×
,, Phillipsii (*Williamson*)	..	..	×
,, sp.	..	..	×
Schizodus deltoideus (*Phillips*)	×	..	..
,, sp.	..	×	..
Aviculopecten papyraceus (*Sow.*)	×	×	..
,, fibrillosus (*Salter*)	..	×	..
,, Cairnsii (*Bolton*)	..	×	..
Modiola	..	×	..
Gasteropoda.			
Raphistoma (?) ornata (*Bolton*)	×	..	..
Naticopsis globularis ((*Bolton*)	×	..	..
Turritella sp.	..	×	..
Pulmoniferons Spiroglyphus	..	×	..

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Cephalopoda.			
Orthoceras teres (*Sow.*)	×	..	..
,, cinctum (*de Koninck*) or O. discrepans (deKon.)	×	..	..
,, obtusum (*Brown*)	×	..	..
,, sp.	×	×	..
Ephippoceras costatum (*Foord*)	×	..	..
,, clitellarim (*Sow.*)	×	..	..
Coelonautilus subsulcatus (*Phillips*)	×	..	..
,, quadratus (*Fleming*)	×	..	..
Discites rotifer (*Salter*)	..	×	..
,, sp.	..	×	..
,, sp.	..	×	..
Temnochilus concavus (*Sow*)	×	..	..
,, carbonarius (*Foord*)	×	..	..
Pleuronautilus falcatus (*Sow*)	×	..	..
Nautilus precox (*Salter*)	..	×	..
Glyphioceras (olim Goniatites) truncatum	×	..	..
,, ,, reticulatum (*Phillips*)	×	..	..
,, ,, diadema (*Beyrich*)	×	..	..
,, ,, paucilobum (*Phillips*)	×	..	..
Gastrioceras (olim Goniatites) carbonarium (*Von Buch*)	×	..	..
,, ,, Listeri (*Martin*)	×	..	..
,, ,, coronatum (*Foord & Crick*)	×	..	..
Dimorphoceras (olim Goniatites) Gilbertsoni (*Phillips*)	×	..	..
Goniatites sp.	×	×	..
Arthiopoda.			
Estheria tenella (*Jordan*)	..	..	×
,, striata (*Munst.*)	×	×	..
,, ,, var Beinertiana (*Jones*)	×	×	..
Leaia Leidyi var. Williamsoni (*Jones*)	..	..	×

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Ostracoda.			
Beyrichia arcuata (*Bean*)	×	×	..
,, Binneyana (*Jones*)	..	×	..
Cytheropsis	×	×	..
Leperditia inflata (*Munst*)	..	..	×
Carbonia Salteriana (? Candona Salteriana)	..	..	×
,, Rankiniana (*Jones and Kirkby*)	..	..	×
,, Bairdiodes (*Jones and Kirkby*)	..	..	×
,, secans (*Jones and Kirkby*)	..	..	×
,, pungens (*Jones and Kirkby*)	..	..	×
,, fabulina (*Jones and Kirkby*)	..	..	×
,, Roederiana (*Jones*)	..	..	×
Cypris (?)	..	×	..
Candona (?) Salteriana (*Jones*)	..	..	×
Bairdia mucronata (*Reus*)	..	..	×
Arthropoda	..	..	..
Anthrapalæmon Etheridge (*Peach*)	×	..	..
Pygocephalus Cooperi (*Huxley*)	×	×	..
Arthropleura (olim Eurypterus) mammatus (*Salter*)	..	×	..
Cyclus Johnsoni	..	×	..
,, Scotti (*Woodward*)	×	..	..
Prestwichia rotundata (*Prestwich*)	×	×	..
,, Birtwelli, *Woodward*	×	..	..
Belinurus bellulus (*Konig*) olim Limulus limuloides	..	×	..
Eoscorpius Sparthensis (*Baldwin*)	..	×	..
Eoscorpius sp.	..	..	×
Myriopoda	..	..	..
Euphoberia Browni (*Woodward*)	..	×	..
,, ferox (*Salter*)	..	×	..
Xylobius sp.	..	×	..
Orthoptera.			
"Orthopterus insect remains" (?)	..	..	×

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Insecta.			
Neuropteris	..	×	..
Etoblattina	..	×	..
Pisces.			
Diplodus gibbosus (*Binney*)	..	×	×
,, tenuis (*A. S. Woodward*)	..	×	..
Pleuracanthus lævissimus, *Agassiz*	..	×	..
,, alatus, *Davis*	..	×	..
,, cylindricus, *Davis*	..	×	..
,, undulatus (*Davis*)	..	×	..
,, erectus (*Davis*)	..	×	..
,, serratus (*Davis*)	..	×	..
,, denticulatus (*Davis*)	..	×	..
,, sp.	..	..	×
Oracanthus Milleri, *Agassiz*	..	..	×
,, sp.	..	..	×
Ctenoptychius apicalis, *Agassiz*	..	×	..
Callopristodus pectinatus (*Agassiz*)	..	×	..
Helodus simplex (*Agassiz*)	..	×	..
Pleuroplax (olim Pleurodus) Rankinei (*Hancock & Atthey*)	×	×	..
,, ,, Attheyi (*Barkas*)	..	×	..
Psephodus magnus (*McCoy*)	..	×	..
Hybodopsis Wardi (*Barkas*)	×	..	..
Sphenacanthus hybodoides (*Egerton*)	×	×	..
Stemmatodus	..	×	..
Acanthodes Wardi (*Egerton*)	×	×	..
Hoplonchus elegans (*Davis*)	..	×	..
Lepracanthus Colei (*Egerton*)	×	×	..
Gyracanthus formosus (*Agassiz*)	×	×	×
Listracanthus spinatus (*Bolton*)	×	..	..
,, n. sp.	..	×	..

Fossils of the Lower, Middle and Upper Coal Measures.	Measures.		
	Lower.	Middle.	Upper.
Euctenuis unilateralis (*Barkas*)	..	×	..
Ctenodus cristatus (*Agassiz*)	..	×	..
,, Murchisoni (*Agassiz*)	..	..	×
Sagenodus inæqualis (*Owen*)	..	×	..
Megalichthys Hibberti (*Agassiz*)	×	×	×
,, intermedius (*A. S. Woodward*)	..	×	×
,, pygmæus (*Traquair*)	×	×	..
,, rugosus (*Young*)	..	..	×
Strepsodus sauroides (*Williamson*)	×	×	×
,, sulcidens (*Hancock and Atthey*)	..	×	..
Rhizodopsis sauroides (*Williamson*)	×	×	×
Coelacanthus elegans (*Newberry*)	×	×	×
Rhadinichthys Wardi (*Traquair*)	..	×	..
,, Planti (*Traquair*)	×	×	..
,, monensis (*Egerton*)	×	..	..
Elonichthys Aitkeni (*Traquair*)	×	×	×
,, Egertoni (*Agassiz*)	×	×	..
,, striolatus (*Agassiz*)	..	×	..
,, semistriatus (*Traquair*)	×	..	..
Elonichthys sp.	..	..	×
Acrolepis (?)	..	×	..
Mesolepsis scalaris (*Young*)	..	×	..
Cheirodus granulosus (*Traquair*)	..	×	..
Platysomus parvulus (*Agassiz*)	..	×	×
Coprolites	×	×	×
Amphibia.			
Archegosaurus	..	×	..
Labyrinthodon (?)	..	..	×
Reptilian remains	..	..	×
Hylonomus Wildii (*Smith Woodward*)	×	..	..

This concluded the business of the Ordinary Meeting.

Museum Publications

(Continued).

C.—POPULAR GUIDES.

W. E. Hoyle. Handy Guide to the Museum. Third edition. [49]

W. E. Hoyle. General Guide to the Natural History Collection (Illustrated) [26] .. ..

D.—NOTES FROM THE MANCHESTER MUSEU

1—T. H. Huxley. Suggestions for a Natural History Museur in Manchester [17] .. ..

2—Thomas Hick. On Rachiopteris cylindrica Will. [18] ...

3—S. J. Hickson. On the Ampullæ of Millepora [19] .. .

4—H. Bolton. Brachiopoda and Mollusca from the Millston Grit. [20] .. ..

5—H. Bolton. Palæontology of the Manx Slates [27] .. .

6—A. C. Seward. Jurassic Plants in the Manchester Museum [30

7—W. Boyd Dawkins. On the Cairn and Sepulchral Cave a Gop, near Prestatyn [36] .. ..

8—F. E. Weiss. On Xenophyton radiculosum (Hick) [37] .

9—W. E. Hoyle. British Cephalopoda [39] .. ..

10—W. Boyd Dawkins. Red Sandstone Rocks of Peel [41] .

11—W. Boyd Dawkins. Carboniferous, Permian, and Triassi Rocks of the Isle of Man [42] .. ..

12—W. Boyd Dawkins. Bigbury Camp and the Pilgrims' Way [43

13—W. E. Hoyle. Use of Museums in Teaching [44] .. ....

14—W. E. Hoyle. The Type Specimen of Loligo eblanæ [45]. .

15—J. R. Hardy. The Macro-Lepidoptera of Sherwood Forest [46

16—W. Boyd Dawkins. On the Discovery of an Ossiferous Caver of Pliocene Age, at Doveholes, Buxton (Derbyshire) [47] ..

17—W. Boyd Dawkins. On the Discovery of Elephas antiqus a Blackpool [51] .. ..

18—W. E. Hoyle. A Diagnostic Key to the Genera of Recent Dibranchiate Cephalopoda [52] 1s

19—T. D. Pinches. The Hymns to Tanmuz in the Manchester Museum [55].. .. .. 3s

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